DISEASE CONTROL PRIORITIES PROJECT

GUIDELINES FOR AUTHORS
(Particularly Part Two Chapters)
updated 16 June 2004

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1. Introduction

These guidelines are intended to help DCP-2 authors conduct the common analyses for different diseases and conditions, particularly in Part Two of the book. The different sections and subsections correspond to topics to be treated in each chapter. They correspond only partly to the suggested chapter outline distributed earlier to authors, because some topics have been combined differently; for example, all the guidance on cost-effectiveness analysis constitutes one section. Some subsections, for example the discussions of events around the time of birth, or of non-constant discounting, will be relevant to only a small number of chapters. Other subsections, particularly that concerning the choice of life expectancies, say which parameter values are to be used, or illustrate the consequences of choosing particular values for the analysis.

To keep the text brief, technical details and specific numerical information are reserved to seven annexes, to be consulted as needed by one or more of the chapter authors. Some annexes will be useful primarily to epidemiologists, others to economists, and so on. DCPP Working Papers corresponding to some annexes either have been prepared (Annex 3) or are in preparation (Annexes 1 and 6) to provide additional numerical information or more extensive explanations, but the material included here should be sufficient for authors to conduct the desired analyses, except where explicitly recognized. All analyses are to be applied so far as data or evidence-based estimates permit. Authors and editors should judge how far that is possible and what approximations or qualitative interpretations are reasonable when data are lacking or judged to be of doubtful coverage or reliability.

Cost-effectiveness analysis as undertaken for DCPP will be generally consistent with the method of Gold *et al.* (1996), modified to assess large changes from the status quo as described in Jamison (2002), taking existing practice as the basis. The average cost-effectiveness of an intervention as currently implemented can be used as the starting point for estimating the cost and outcome of (1) expanding the coverage, possibly up to the estimated maximum feasible application of the intervention; (2) reducing coverage, possibly to zero (eliminating the intervention altogether); or (3) replacing the intervention with another directed to the same condition and population. The replacement may not be an entirely different intervention but a substantial modification of current practice. In all these cases, the existing intervention *at its current scale* serves as the comparator for the alternative, including alternatives that differ in scale and may on that account be more or less costly or more or less effective. This approach allows for new investments to be made as needed, estimating their costs and outcomes, or for capacity created by past investments to be abandoned or shifted to other uses.

Geographically, the analysis is to be conducted for each of the following six low and middle-income World Bank regions where the disease or condition exists and the interventions discussed in the chapter are relevant: East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, South Asia, and Sub Saharan Africa. Data originally presented for the 17 WHO Global Burden of Disease sub-regions have been converted by WHO to World Bank regions by aggregation and by

shifting estimates for individual countries from one region to another as needed, weighting by population size. Authors are asked to consider a typical epidemiological situation in a given region at a given income level, with typical resource uses and costs, recognizing that there remains much variation among and even within countries. Annex 1 indicates which countries are included in each region and provides a compact description of a representative regional population of 1 million. Analyses for individual countries, particularly China and India, will be welcomed as an addition.

Authors are encouraged to discuss any issues arising from these guidelines with the editors and the chief economist. The guidelines are meant to assure a common basis of analysis—medical, epidemiological, economic—rather than to limit the content of chapters or preclude other types of analysis of interest to authors and for which data and evidence exist. A number of print and on-line references are provided for authors.

2. The Nature, Causes, and Epidemiology of the Disease or Condition

This section will provide a brief summary of the principal features of the disease or condition:

Characteristics of the condition, including causes, clinical manifestations, duration, variation through time and across individuals, symptomatic and asymptomatic states, severity, case-fatality, typical age at onset and at death, etc.;

Epidemiology: geographic distribution, prevalence, incidence, mode(s) of transmission for communicable diseases, infectivity, variation through time, epidemic or endemic nature;

Risk factors for exposure, development of a condition, severity and other characteristics, including genetic, behavioral and environmental factors, their interactions, and the degree to which they can be modified. The identification of risk factors is particularly important for determining which policy instruments may be appropriate for promoting interventions or making them more cost-effective, as discussed in section 4.8 below; and

Differential impact on the poor, across and within countries; inequality and inequity in any of the characteristics listed here. If the current burden of disease is concentrated among the poor or other disadvantaged groups, that has important implications, as discussed in section 4.6 below, for the cost-effectiveness of extending interventions to those groups from the population that is already protected and therefore suffers less burden.

3. Burden of the Disease, Condition or Risk Factor

This section will describe the burden of disease specific to the condition or risk factor The principal source of information will be Burden of Disease estimates from the World

Health Organization. Additional sources of information besides the WHO estimates may be used at authors' discretion, provided estimates of prevalence, incidence and other characteristics (which may come from distinct sources) are consistent, and discrepancies from the WHO estimates are explained. Such discrepancies may lead to recommendations for research and improvements in data, and their consequences for cost-effectiveness should be discussed.

3.1 Units and parameters

Authors should first present estimates of burden in natural units—cases, deaths, years of life lost (YLL) and years lived with disability (YLD). These units should be converted to DALYs, as indicated in Annex 2. DCPP will not use the WHO age weights, so they are omitted from the explanation in Annex 2. WHO has provided a version of the burden of disease estimates without age-weighting which DCPP uses consistently; these data are on the DCPP web site and are also available from the Secretariat.

All calculations should use the standard WHO constant discount rate of 3% per annum, and preferably also a constant discount rate of 6%. A non-constant (declining or "slow") discounting procedure may be applied in a few instances where the effects start only long after the intervention or last for an exceptionally long time. Annex 3 provides further explanation of the choice of discount functions and rates, for both the burden of disease estimates and the calculation of cost-effectiveness.

The chapter in Part One on burden of disease will disaggregate the total burden by:

- region
- age
- sex
- the distinction between mortality and morbidity or disability, and
- where relevant, the degree of severity (e.g., for anemia) or the distinction among different sequelae of the same disease (e.g., for malaria).

For each particular disease or condition, authors should highlight those breakdowns of the total that are of particular interest or relevance to the cost-effectiveness analysis. Disaggregation of the burden according to what has already been averted, what is currently avertable and what cannot be dealt with using existing tools, is treated in section 5 below.

3.2 Events around the time of birth

Stillbirths are not currently counted in the WHO estimate of the burden of disease. To include them will require weighting events around the expected time of birth, so that a death during or shortly before delivery does not count as a greater burden than a death shortly after live birth. DCPP will propose a procedure for estimating the additional burden due to stillbirths and its consequences for the burden of death in early childhood. This procedure can then be applied to cost-effectiveness analysis of those relatively few

interventions, delivered to pregnant women, which affect the probability of successful live birth.

4. Cost-effectiveness analysis (CEA) of interventions

4.1 Choosing and classifying interventions

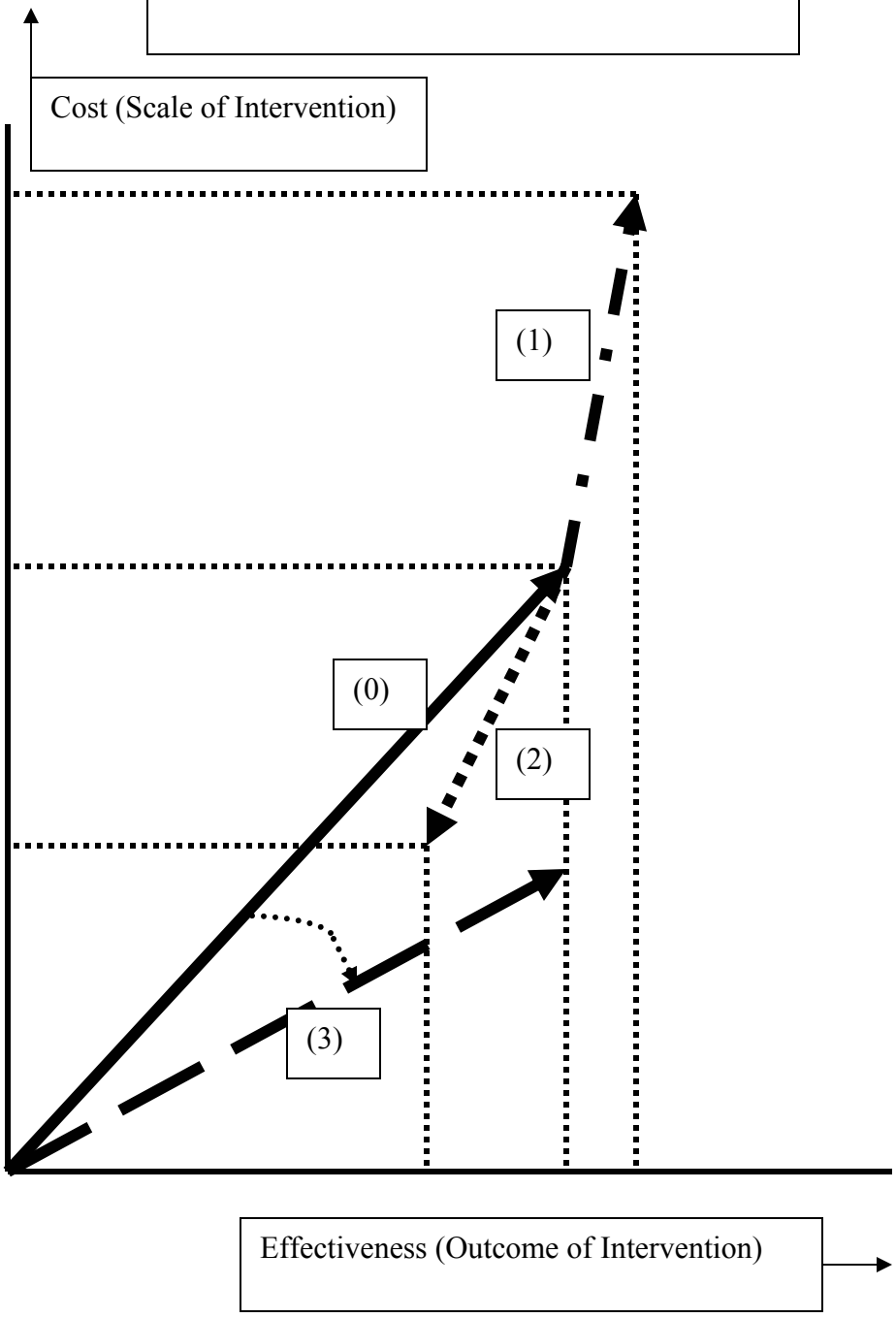
"Intervention" will mean either increase or decrease (including possibility of dropping altogether) in existing activities—that is, changes of *scale*; or adding a new activity (either to replace an existing one or to add a new one where there is no current activity)—that is, changes in the *nature* of an activity. Figure 1 illustrates these possibilities of expansion, contraction and replacement (the results for cost-effectiveness are discussed later).

For some conditions or risk factors, many more interventions exist than can be adequately analyzed in a chapter. Authors should select interventions to be analyzed according to whether there is evidence that they are likely to be cost-effective; that they are of unknown or doubtful effectiveness or cost-effectiveness, but are, or are likely to become, widely used in spite of the lack of evidence; or there is evidence that they are ineffective or even harmful. Annex 4 provides a three-part classification of the quality of evidence. Annex 5 describes the definition of an intervention and the information requested concerning each one selected, which will permit classification and comparative analysis on various dimensions.

Since the importance of an intervention, in either health or other outcomes or in financial implications, may be unrelated to the amount and quality of evidence about it, authors should try to evaluate all (potentially) important interventions, using all the available information. The objective of DCPP is not only to produce a collection of "best buys", interventions for which cost-effectiveness is known to be high. It is also intended to identify, if possible, any "worst buys", and also to provide more evidence concerning interventions that are important because of the scale or cost of their implementation, but about which little is currently known.

The chapter should highlight the geographical range of evidence—the environments and countries in which such evidence is found. Authors should indicate when two interventions are mutually exclusive, requiring a choice between them, and when they are not mutually exclusive and can be combined in a package. Evidence on particular interventions will also be used, as appropriate, for chapters in Part Three of the book. Authors are urged to share sources of information and preliminary results early with Part Three writers; the responsible Editor will facilitate these collaborations.

Figure 1. Cost-effectiveness analyses, starting from the current coverage of an intervention and considering changes in scale or shifts to other interventions



(0) Average CE of current coverage of existing intervention
(1) CE of expanding that intervention (shown as worsening)
(2) CE of curtailing that intervention (shown as improving)
(3) CE of an alternative intervention for the same condition and the same population (shown as improving)

4.2 Estimating intervention effectiveness

Taking into account the quality of available information, the chapter will assess for which of the selected interventions there is strong, or only mixed or inconclusive evidence of impact on—

Health *outcomes*, e.g. cases averted, deaths averted, years of life gained, disability-free years gained, DALYs averted, or other measures. In the first instance, authors should use whatever natural outcome measures are widely used for analyzing the particular condition(s). Conversion to DALYs will follow the same procedure as for disease burden estimation (Annex 2), except for assumptions about life expectancy, as explained below.

Health-promoting interventions also sometimes pose risks to the intended beneficiaries and cause direct health damage in some fraction of recipients. This is most evident for certain clinical procedures, but even preventive interventions may carry risks. A small number of polio cases result from immunization with oral vaccine; and a vaccine for rotavirus, although highly effective against life-threatening diarrhea, was withdrawn from the market because it posed a very slight mortality risk. Whether an intervention is cost-effective depends on the net effect on health—if it averts many more deaths or disabilities than it causes, at a reasonable cost, it is still to be recommended. But perceptions of safety, and the willingness to introduce an intervention or to promote demand for it, also turn on the probability of health losses due to the intervention. Authors are therefore urged to discuss both the gains and the likely losses to health from an intervention, and not only the net result. The balance of health gained and health lost may be crucial to some choices of intervention, as for example between oral (live) and injectable (killed) poliovirus for immunization. In addition, authors should consider effects in the form of--

Non-health outcomes, e.g. changes in time saved (as from piped water installation) or other amenity benefits; school attendance or performance; or reduction in impoverishment (resulting either from protecting or improving earning capacity or from reducing the risk of poverty from large out-of-pocket payments).

The chapter will aim to quantify the size of expected changes in outcomes from expanding (or reducing) the scale of interventions, or introducing new interventions, *compared with current practice*, particularly the *most frequently used intervention* for the patient/population group in question, and to identify the variables associated with changes of magnitude where quantification is not possible. Authors are encouraged to consider what the maximum benefits of interventions are likely to be (e.g., whether 100 percent coverage of an intervention can be well defined and appears feasible) and to consider how the size of expected outcomes is likely to change with the size of the program. Assessments of effects/benefits may have to extend beyond the period covered by available evidence.

A summary of the evidence for each intervention or specified combination of interventions will be part of the background documentation supporting the chapter. This will include the assumptions behind calculations of effectiveness, e.g. the proportion of

burden that could be averted given a specified coverage of an intervention, and will indicate actual (measured) and potential (estimated) ranges of each estimate. For each intervention or combination of interventions, estimates of effects (and of costs) should come from the best available evidence. The data may come from different sources (possibly requiring adjustment or modeling) and include data of varying quality and accuracy, ranging from randomized controlled trials to expert opinion. Annex 4 provides a standard classification of data quality. The analysis should consider the options of a modest and a major change in types and scale of intervention(s) in each region. Authors should also consider what evidence exists on constraints (economic, political or other) to such changes in different environments.

The assessment of effectiveness will draw on a review of existing literature. To the extent possible, estimates originally published in different units should be harmonized, at least approximately, by conversions between cases, deaths, years, etc. and DALYs. New or revised estimates of intervention effectiveness should be prepared for a model population of 1 million in each region (omitting the analysis for a region if the condition or risk factor is of little or no significance there), with the age and sex distribution and other features typical of that region, as summarized in Table 1-1 of Annex 1.

4.3 Choice of life expectancy for effectiveness analysis

Tables 1-2 and 1-3 in Annex 1 show WHO estimates of life expectancy by World Bank region and for the low and middle-income countries as a group as well as for the world, by sex, at birth, age 1, and at five-year intervals from age 5 to age 80. These numbers are used to estimate the cost-effectiveness of interventions, whereas the burden of disease in all regions is estimated from the "standard" age-specific life expectancies that begin at 80 years for men and 82.5 years for women at age 0. The problem with using the standard expectancies to compute effectiveness of an intervention is that a death averted at age a in a high mortality region does not guarantee the beneficiary the same life expectancy from that age on, as if he or she lived in a region with low mortality. DCPP therefore follows the WHO assumption that the person faces the same probability of death at each subsequent age, as the existing population. This is equivalent to supposing that period life expectancy is identical to cohort life expectancy. This is a good approximation for interventions that, although they avert some deaths, have little effect on overall life expectancy or the cohort survival curve. It has the effect, however, of making every intervention appear less effective when overall mortality is high than when mortality is low; effectiveness is inversely correlated with disease burden.

The argument for this choice is that estimates of what an intervention can accomplish will be more realistic than if effectiveness is calculated assuming that those saved from death at one age will thereafter face only the same risks as the population of a low mortality region. Averting an infant death in Sub-Saharan Africa will actually save, on average, 44-49 life years and should not be credited with saving 80 years or more. This means, however, that cost-effectiveness calculations and estimates of burden of disease are inconsistent in the following sense: effective interventions appear able to deal with only part of the burden that they are intended to control. In the example just mentioned, the

burden of an infant death is 80 life years lost, but the gain from preventing that death is less than 50 years, or only 55-61% as great. The share of burden that an intervention appears to control depends on the regional life expectancy, and also on the units in which burden is measured. If the future years of life are discounted at 3% per year, use of life expectancy in sub-Saharan Africa means a loss of 26.4 DALYs while the standard life expectancy of 80 years raises that only to 30.3 DALYs; preventing a death appears to control 87% of the burden.

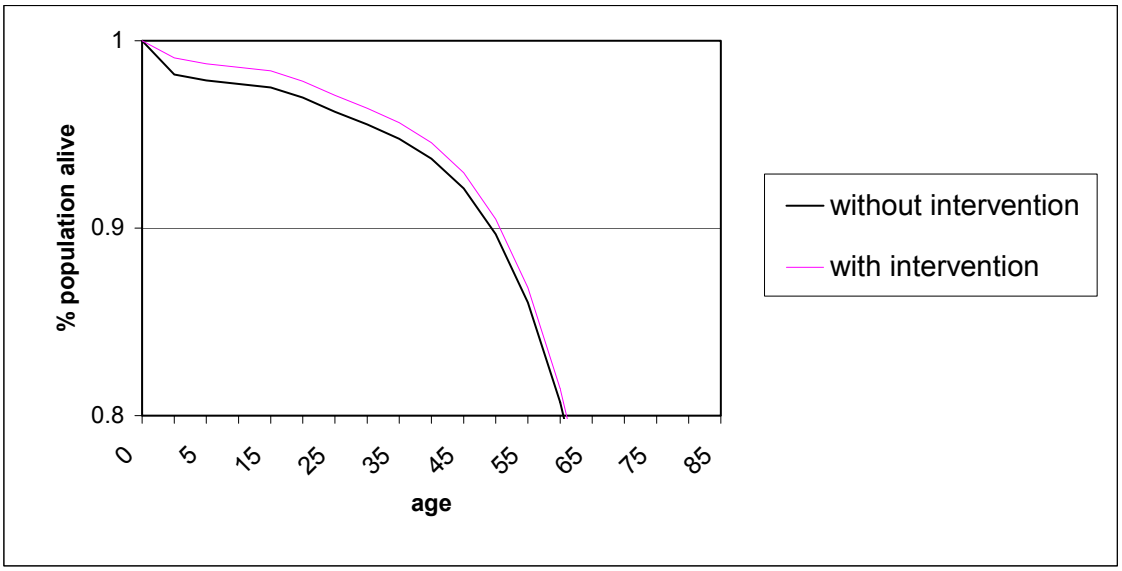
A second effect of the decision to use regional rather than standard life expectancy is to make interventions in a high mortality region appear more effective, relative to outcomes in a lower-mortality region, as they avert deaths later in life—despite the fact that the disease burden is concentrated at young ages. As the age-specific life expectancies show, averting a male death at age 60 in Sub-Saharan Africa saves (14.51/16.71) or 87 % as many life years as averting a death at that age in Latin America and the Caribbean, whereas averting a death at age 1 is only (48.73/68.65) or 71 % as effective in saving life years in the former region as in the latter. (What happens to relative cost-effectiveness depends on costs, and does not necessarily yield the same kind of shift to later ages.)

The assumption that period and cohort life expectancy coincide is a good approximation as long as the changes caused by the intervention do not considerably change age-specific life expectancies. A 50% reduction in infant mortality can, however, substantially change life expectancy at birth. Suppose that an intervention averts half the deaths among 100,000 infants in a population with a life expectancy at birth of 71.95 years and an infant mortality rate of 18.03 per thousand. The total number of life-years gained calculated according to the assumption of unchanged life expectancy would be the number of lives saved (901.5, or half of the 1,803 deaths that would otherwise occur) times the life expectancy (71.95 years) which equals 64,790. However, the correct total number of life-years saved equals 0.65351 x 100,000 = 65,351, because the reduction in childhood mortality in this hypothetical population increases life expectancy at birth by 0.65351 years. An intervention has no effect on age-specific life expectancy (to two-decimal accuracy) after age one. There would be effects at later ages, and a larger effect in infancy, if age-specific death rates were substantially higher and the intervention still averted half the deaths.

The effect of an intervention on life expectancy and years of life saved is to shift the survivorship curve, which shows the proportion of a birth cohort (exposed to a set of age-specific death rates) that survives to any age. Figure 2 shows the survivorship curve for the life table corresponding to this example. As a result of the intervention reducing infant mortality by 50%, the curve shifts upwards. Years of life lived for the population, equal to the area under the survivorship curve, is increased by 65,351 life-years. This can also be seen as the difference in the total number of life-years lived without and with the intervention (7,260,660–7,195,309). For interventions with a relatively large impact on age-specific mortality implemented over a number of years, period life expectancy (before the intervention) will not be a good approximation of the population health gain. In such cases, a population projection model is required in order to estimate the full intervention benefit in years of life lived.

Figure 2. Survivorship curves with and without an intervention

These curves refer to a cohort of 100,000 infants in a population with a life expectancy at birth of 71.95 years and an infant mortality rate of 18.03 per 1,000 live births. The intervention that shifts the survivorship curve prevents 50% (901.5) of the infant deaths and has no effect at later ages. Life expectancy at birth increases as a result of the intervention by 0.65351 years, to 72.60 years.



Authors are urged to use the simpler assumption that overall life expectancy does not change, when estimating the effectiveness of an intervention that affects only a small share of the population or takes effect well after infancy. Estimating the effect on the life table and calculating a more accurate estimate of years of life (or years of healthy life) saved is desirable whenever the intervention can be expected to make a significant difference to life expectancy. This consideration may be important when estimating how the effectiveness and cost-effectiveness of an intervention would differ according to the scale of implementation; an activity might have no effect on life expectancy at small scale, but a significant effect if expanded to all the potential beneficiary population.

4.4 Intervention Costs

As with the assessment of effects, authors should review any evidence available on the changes in costs associated with expanding (or reducing) the scale of interventions, or introducing new interventions, *compared with current practice*. There are potentially three kinds of costs associated with any intervention: damage to health for some of the recipients, as discussed in section 4.3; demands on institutional capacity for organizing and delivering the intervention; and conventional costs of using real resources—people, buildings, equipment and supplies. The cost of creating or improving institutional capacity is hard to quantify, but needs to be discussed whenever the expansion or modification of an intervention cannot easily be achieved just by spending money on more resources. Authors are asked, in Annex 5, to provide a rough judgment of how demanding of such capacity a particular intervention is. Improving capacity or overcoming institutional limitations may require the use of one or more of the policy instruments discussed in section 4.8 below.

Most interventions require some combination of a number of relatively standard inputs, so cost estimates can be created from unit prices for those inputs—which are common across interventions—and input proportions, which are specific to each intervention and must be specified by authors. Annex 6 provides a large set of regional input prices; estimates for the majority of these costs are provided by WHO or developed by the London School of Hygiene and Tropical Medicine from WHO estimating procedures. Cost estimates account for inflation when data differ by year, and are adjusted according to purchasing power parities. Authors should follow the suggestions in Box 6-3 of Annex 6 for costs not specifically provided here.

The appropriate time horizon for the cost analysis will vary with the nature of the intervention considered. When the introduction or expansion of an intervention implies substantial one-time start-up costs, as distinct from the regular use of capital with a lifetime of more than one year, it is suggested to amortize these over ten years in calculating the cost of the intervention. (Amortization of capital costs—buildings, vehicles and equipment—according to standard lifetimes is dealt with in Annex 6.) Authors should also consider whether there is a significant probability of change in the circumstances assumed for the analysis within the next decade or so, and conduct sensitivity analysis with different horizons to see the consequences for cost-effectiveness. This is likely to be particularly important when the intervention is aimed at disease

eradication or elimination or when technological change appears likely to make the intervention obsolete within a relatively brief period.

The analysis should take the perspective of society, and include all effects and all directly related costs, no matter who benefits from them or pays for them. Nonetheless, the costs borne by providers, patients and their families and others should be separated so far as possible, to allow judgments from the viewpoint of different decision-makers.

There is not yet a professional consensus on the issue of how properly to account for costs that are not costs of intervention as such but result from the successful implementation of the intervention, including the net resource costs (for health and for other forms of consumption) that will be incurred in future because life is extended. The standard DCPP analysis will not include such costs, both because of the practical difficulties of estimation and because their inclusion involves conceptual and ethical issues concerning differences in incomes. Authors who consider the issue important for their chapters because the particular conditions and interventions studied are likely to involve substantial unrelated future net costs, particularly for the elderly, are urged to review Luce, Manning, Siegel and Lipscomb (1996) and Meltzer (1997) and judge whether and how they wish to deal with such costs.

Authors are asked to provide a summary of the expected resource use and unit costs for each intervention or specific combination of interventions as part of the documentation supporting the chapter. This will include specifying the assumptions behind calculations of costs, e.g. amounts and types of health service use with and without the intervention, given a specific coverage of the intervention and indicating actual and potential ranges of each estimate. (How much of this belongs in the chapter rather than in a background paper will depend on the complexity of the material, the amount of space available and the judgment of the authors and the responsible editor.) When two or more interventions are combined, the cost-effectiveness analysis should consider known or likely outcomes and costs of the package of interventions, not necessarily assuming additivity in either effects or costs. Neither should authors assume that input proportions are constant from place to place.

The optimal level of coverage, compared to using the resources for other interventions, depends on what happens to the cost-effectiveness ratio as the intervention is expanded. This is the analysis of greatest interest, particularly when the potential expansion would address a large burden of disease. Similarly, the decision to reduce the coverage of an intervention or to stop providing it altogether turns on comparing the cost savings with the increase in burden that would result and judging whether the same burden could be averted for less cost or the same expenditure could avert a larger burden, with a different intervention. Examples of reductions in interventions that bear examining are closing psychiatric hospitals and using community-based treatment; dropping one immunization (BCG) from the EPI schedule to eliminate the need for one child contact; or reducing the frequency of screening for breast or colon cancer.

4.5 Linking costs and effects of interventions

The aim is to develop estimates of intervention cost-effectiveness for a population of 1 million in each region, compared with current practice. Table 1-1 in Annex 1 provides a profile of what a representative population of 1 million looks like. The analysis will involve using the evidence on effects and costs of interventions, which will not always have been estimated together, and may mean putting information together by adding resource and cost data to an epidemiological or decision model of intervention effectiveness, or developing a new model. Information will often be incomplete; Annex 7 offers some suggestions on how to proceed with the analysis under different combinations of data on costs and on outcomes.

Given estimates of cost-effectiveness and other characteristics of interventions, including non-health benefits, authors are asked to consider two different ways of expressing constraints on funding of interventions—via a fixed budget or a threshold level of acceptable cost per DALY gained: First, with a budget of Int$ 1 million for each region, what interventions would you recommend funding on the basis of cost-effectiveness (or other criteria) ? Second, given a decision-maker's willingness to pay of $INT 1/25/100/500 per DALY gained, what interventions would you fund for a population of 1 million in each region ? Comparisons of cost-effectiveness will allow authors to account for interventions that are dominated by other interventions (less effective for the same or higher cost, or more costly for the same or lesser effect) and those that are subject to extended dominance (Karlsson and Johanesson 1999).

Cost-effectiveness ratios will vary across settings, because of differences in resource costs and in life expectancies. Authors should consider other factors influencing cost-effectiveness, including ecological or environmental conditions. Sensitivity analysis may be used to indicate which factors have significant impacts on cost-effectiveness, including rates of prevalence or incidence of the condition, transmission rates of communicable diseases, ages of those affected, co-morbidity, and the resource combination(s) required for interventions and their input prices. The cost-effectiveness of expanding or curtailing interventions will also depend on differences between the population currently covered by an intervention and the population for which the intervention is to be extended or withdrawn.

4.6 Distributional and equity consequences

In general, the population already receiving or protected by a particular intervention will differ in some important features from the population not yet covered that is at risk from the same disease or condition—it will be richer, or more urban, or may differ in age, education or whatever other characteristics affect the likelihood of coverage. In consequence, the extension of coverage may imply unit costs, or effectiveness, or both, that differ markedly from current averages. If the intervention is now implemented mostly among the population that is easiest to reach, then expansion is likely to raise costs. It does not follow that cost-effectiveness will decline when coverage is expanded, because effectiveness may rise even more than costs do. This can happen because

incidence is higher among the unprotected population, as with malaria in rural areas or diarrhea among children without access to safe water. It can also happen because for a common risk of incidence, severity is greater among the unprotected population. Measles incidence in the absence of immunization may be roughly equal for all children, but under-nourished children are much more likely to die as a result. Immunizing them is therefore likely to be more cost-effective than average for the intervention. Figure 1, below, illustrates the case where expansion worsens cost-effectiveness—the increase in costs exceeds that in health gains—and contractions improves it, but the outcome may be just the reverse. Similarly, a switch from one intervention to another may allow the benefits to be extended to previously hard-to-reach and high-risk groups, affecting the cost-effectiveness of the change.

Authors are urged to estimate the distributional impacts of the interventions analyzed and to note how far their implementation would affect equity. Whenever the currently unprotected population is at equal or greater risk than those already covered, and in addition suffers some equity-related disadvantage such as poverty, any move in the direction of universal coverage is likely to be equity-enhancing whether it improves or worsens cost-effectiveness. Symmetrically, in considering reductions in coverage of an intervention or its complete withdrawal, authors should examine the implications for equity. This analysis should draw on any available information concerning the distribution of the burden of disease, as mentioned above in section 3.

Table 1 summarizes the principal assumptions of the cost-effectiveness analysis.

4.7 Reporting results

All numerators and denominators of rates and proportions should be reported individually, for totals, averages and changes of type of intervention. Estimates of central tendency should be accompanied by appropriate estimates of intervals. Both relative and absolute estimates of risk should be provided, along with the period of time over which they were calculated. Cost-effectiveness ratios or functions should be uniformly expressed as outcome (deaths averted, DALYs gained, impoverishments averted) per million Int$ of expenditure, rather than simply as the cost in dollars of achieving a particular outcome. Table 2 shows the desired minimum data to be reported for each intervention.

4.8 Policy instruments for behavior change, including increased demand for or compliance with interventions

Cost-effectiveness calculations require estimates of the actual extent of coverage of an intervention, that is, how many people actually use it and benefit from it. This coverage may be less than what was intended or provided for, so that there are costs associated with offering the intervention that do not result in any benefit. How much of what is offered is actually taken up depends, for many interventions, on demand from the intended beneficiaries. Authors need therefore to consider two issues—

Table 1. Assumptions for cost-effectiveness analysis

1. Societal perspective, including all costs and benefits or losses
2. Opportunity based costing for valuing all resource inputs
3. Use of standardized input prices by region; capital inputs (buildings, equipment, vehicles) to be amortized at standard lifetimes
4. All costs reported in year 2001 international dollars
5. Authors determine assumptions about levels of quantities of inputs (resource use) to interventions
6. Regional life expectancies by age and sex, and changes in them due to the intervention, used to calculate life years gained or DALYs averted
7. Interventions assumed to run for 10 years and include any start-up costs
8. Importance of stillbirths to be estimated for the burden of disease and for cost-effectiveness of those interventions affecting the likelihood of live birth
9. Presentation of cost-effectiveness findings—first, in natural units (cases, deaths, years of life, years with disability); second, converted to DALYs (discounted, not age-weighted)
10. The scale and consequences of an intervention, relative to constraints on funding, can be described in two ways:
Option 1 Cost and effects of applying the intervention to a target population of: 1 million in each region analyzed
Option 2 Coverage and effects of spending Int$ 1million on the intervention
Authors may also describe the cost-effectiveness of interventions on the basis of willingness to pay per unit of effect at one or more arbitrary levels such as Int$1, 25, 100 or 500 per DALY averted. The emphasis, however, should be on what could be accomplished by spending Int$ 1 million.

first, what factors (price, physical accessibility, knowledge on the part of potential consumers, how the health system treats people, etc.) appear to determine demand; and.

second, what policy instruments, as defined in Annex 5, appear likely to increase demand by affecting one or more of those factors, and at what cost.

Authors should consult any relevant existing analyses of demand for the interventions considered, and provide as much qualitative discussion as possible of the influences on utilization when no such analyses exist. The intention is to ensure that the estimates of effectiveness are realistic and that estimates of cost correspond to levels of uptake that could actually be achieved rather than to potential coverage levels when demand is unlikely to reach those levels. Oversupply of an intervention relative to demand may dramatically worsen its cost-effectiveness.

Demand for an intervention need not be taken as fixed, if one or more policy instruments can be employed to increase it. Authors are asked to indicate which of five such instruments are particularly relevant for stimulating the utilization of an intervention

Table 2. Minimum reporting for each intervention and geographic region (illustrated by two possible changes in care provided during pregnancy or at delivery)

Cost, effectiveness or benefit concept	Current practice	Intervention 1 (reducing episiotomy rates to 30% of deliveries)	Intervention 2 (adding a new package of evidence-based antenatal care)
Total Cost			
Profile of total costs *Recurrent:* % in-patient stay % ambulatory care % Labor level 1 % Labor level 2 % Labor level 3 % Labor level 4 % Pharmaceuticals % Laboratory expenses % Other *Capital:* % Buildings % Vehicles % Equipment % Other			
Total Effects: cases averted deaths averted life years saved DALYs gained			
Total Benefits: Monetary benefits Non-monetary benefits			
Size of target population			
% target population reached			

when it appears that demand may fall far short of the potential for benefit at reasonable cost. It will often be difficult to perform a full second-order analysis of the cost-effectiveness of policy instruments, because a given instrument may affect numerous interventions and yield multiple health and non-health outcomes. Authors should therefore concentrate on instruments for which there is evidence of direct impact on one or more of the interventions discussed, and attempt to estimate the cost of applying those instruments.

Where cost to the consumer is a major deterrent to uptake, subsidies or direct expenditure to finance provision are likely to be crucial, and their costs are simply the cost of the intervention or (in the case of subsidy) some fraction thereof. The cost-effectiveness of

the intervention itself will vary depending on who pays for it, insofar as costs or outcomes depend on the scale of implementation, and subsidies or direct expenditures affect that scale. While the emphasis in DCPP is on total cost from society's perspective, authors are also asked to distinguish who pays those costs.

Information, education and communication (IEC) to stimulate demand or reduce resistance to an intervention involve costs that are not simply costs of the intervention itself. Where this is likely to increase utilization, authors can proceed to analyze the instrument in two ways. One is to estimate the cost-effectiveness of the intervention without an IEC campaign, and then estimate the costs of such a campaign and its effectiveness in expanding utilization. The resulting recommendation might be to accept the intervention at smaller scale without using IEC; or it might appear that the intervention is not cost-effective and should not be undertaken without an IEC campaign. The other approach is to define the intervention to include an appropriate IEC campaign, particularly if that appears essential to its success.

Increasing the demand for, or compliance with, a specific intervention is only one way that policy instruments can potentially improve health. More generally, the object of using several of these instruments is to promote changes toward safer or more healthful behavior. Much of IEC, for example, is not directed toward the use of particular interventions, but rather toward getting people to wash their hands, eat a more healthful diet, exercise more, practice safe sex, abstinence or faithfulness, and so on. In such cases, the use of a policy instrument is itself commonly described as an intervention.

Taxes provide another example of an instrument used to change behavior. This instrument may be important when the aim is to reduce consumption, as with tobacco, and the effectiveness is the reduction in disease burden resulting from that lower consumption. Here the intervention is the reduction of smoking, and the instrument to promote the intervention is a higher tax on cigarettes. Using taxes on goods, services or activities also has costs, both in enforcing collection and in distortions of economic activity, and these costs should be compared to the health (or other) benefits from using the instrument.

Engineering design is still another way to promote behavioral change. Speed bumps, stop lights and signs, and well-designed roads are all engineering responses to the risks of vehicular traffic, and they all imply costs over and above the cost of building and maintaining roads without such safety features. These costs should be set against the improvements they cause in health from fewer or less dangerous accidents. There may also be significant non-health benefits, as from less pollution, less congestion and shorter travel times or savings in fuel or maintenance.

The two other policy instruments—regulation and legislation, and research and development—do not lend themselves so easily to this kind of comparison of costs and outcomes. Authors are encouraged nonetheless to specify the kinds of R & D that seem most important for increasing the amount of burden that could be averted but is not now averted because of inadequate demand or other barriers to implementation of an

intervention, or because of unhealthful behaviors. For regulation and legislation, the analysis should consider the additional utilization that could be obtained under appropriate regulation, or the additional risk that could be averted, and the cost of enforcing laws or regulations. Authors should draw on such evidence as exists about the effects of introducing or changing laws and regulations, particularly where regulation can be tighter or looser and imply very different levels of cost or of outcome.

Policy to change behavior may be directed as well toward providers of interventions, to improve their effectiveness or that of the institutions where they work. Particularly when constraints on institutional capacity—managerial, technical or financial—limit the coverage or effectiveness of an intervention, authors should consider which policy instruments could help overcome those limitations.

5. Averted, Avertable and Non-Avertable Burden of Disease

The burden of disease is defined as all the ill health that remains after the past or current application of interventions. The amount of burden that has already been controlled—that is, potential health loss that no longer appears in the estimate of remaining burden—is illustrated in Figure 3 as the product of the population coverage (X) and the effectiveness of the interventions (Z). Authors are urged to estimate the amount of already averted burden of a disease or condition—that is, how much additional burden would exist, were it not for the interventions currently applied or the continuing benefits from interventions delivered now or in the past (for example, smallpox eradication). For some interventions this may be fairly straightforward: it should be relatively easy to estimate the number of additional cases of a vaccine-preventable disease, and the health damage from them, if there were no immunization. For interventions directed to diseases or conditions that respond to many risk factors and for which the natural or background level of incidence is not well known, such as cardiovascular disease, an estimate may be impossible or very rough. The intention is simply to form some idea of how much potential burden is already under control—this will sometimes be the basis for the "success stories" discussed in Part One—and how much remains to deal with.

Some of the remaining burden is often not avertable or controllable with known interventions; in that case what is needed is research to develop new, more effective or less costly interventions. Another part of the burden is usually susceptible of reduction by more extensive or more efficient implementation of known interventions, including the replacement of one existing intervention by another. Authors are asked to divide this controllable burden between the part that could be averted by interventions that are clearly cost-effective, and the part that could be averted only by interventions that appear to be substantially less effective or more costly. Expansion of the currently applied cost-effective interventions, with no change in their efficacy or effectiveness, would allow further reduction in burden up to the maximum feasible population coverage (Y). A principal aim of DCPP is to direct attention to large remaining burdens that could be controlled cost-effectively. That amount of burden corresponds to the area in Figure 3 bounded by the lines at X, Y and Z. With existing knowledge, coverage beyond that

level would involve interventions of such low cost-effectiveness as not to be justified. The distinction between more and less cost-effective depends on the context, including the composition of disease burden, the income and health system capacities of the country and the characteristics of other, competing interventions.

The priorities for disease control that emerge from the DCPP analysis can be grouped as indicated in Figure 3, into three categories—

(1) *expansion* of cost-effective or otherwise desirable interventions to control more of the avertable burden . This scaling up may be accompanied or facilitated by improvements in how the interventions are organized and delivered. A major objective of DCPP is to identify those interventions for which such expansion appears justified, the obstacles to increased coverage and the changes that may be necessary for the expansion to be feasible and cost-effective;

(2) *research and development* to improve the effectiveness or reduce the cost of existing interventions which are not cost-effective enough to justify their implementation; and

(3) *research and development* into new interventions, to expand the amount of avertable burden and reduce the burden that currently cannot be dealt with. The objective is to identify those investments in R & D that appear most likely to pay off in substantial reductions of burden at reasonable cost.

In general, the object of disease control is two-fold: to move up the boundary in Figure 3 between what is avertable and what is not; and to move to the right, the boundaries between averted and avertable burden and between what can be achieved cost-effectively and what cannot. As these shifts occur, life expectancy will increase, improving cost-effectiveness as calculated from regional expectancies.

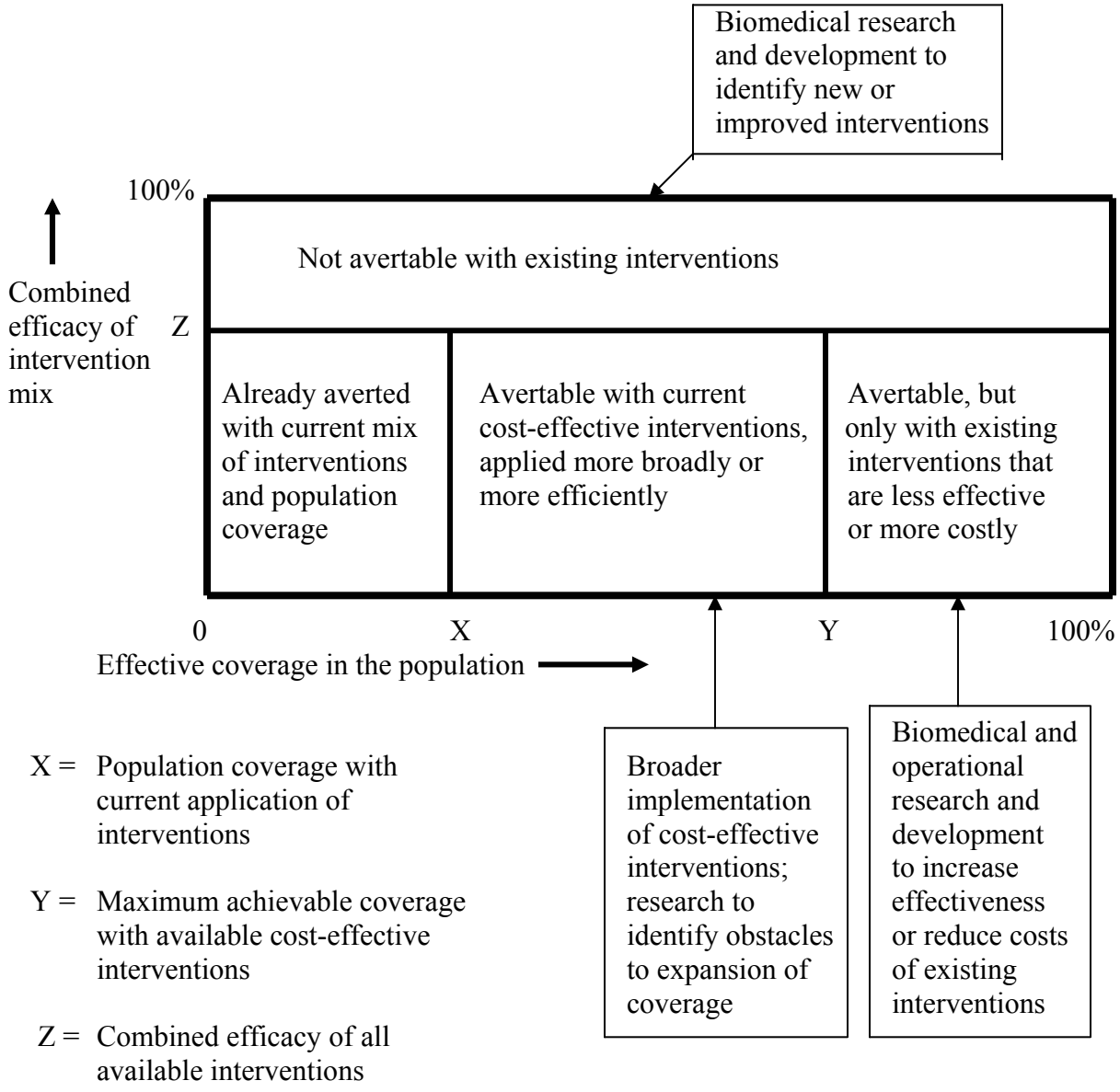
6. The Economic Benefits of Intervention

Findings from this section will also be used in Part One B of the book, concerning the overall benefits of improved health.

6.1 Increased conventionally-defined income

One kind of benefit depends only on the provision of an intervention and is independent of who pays for it: that occurs when the intervention results in increments to GDP as conventionally measured. Increases in income can follow from increased labor force participation or improved productivity because people are healthier, as with many interventions affecting adult health; from cost savings in other interventions which become unnecessary because of improved health, as when a preventive intervention frees resources otherwise needed for curative care; or from changes in where people live and their occupations because an intervention makes a geographic area more healthful and

Figure 3. Share of disease burden that has been, can be, or cannot be averted with existing interventions, distinguished according to their cost-effectiveness



Source: modified from Figure 1.1 of the Report of the Ad Hoc Committee on Health Research, *Investing in Health Research and Development*. Geneva: WHO, 1996.

fertile land becomes available for cultivation, as with onchocerciasis control. Authors should examine the evidence that the interventions studied have one or more of these secondary effects beyond the improvement in health they provide.

6.2 Protection from financial risk

A second kind of economic benefit, in contrast, depends not only on the provision of an intervention but also on who pays for it. If the potential beneficiaries of an intervention either cannot afford to pay for it and therefore do not use it, or can pay for it only by becoming impoverished, then an increase in financial protection reduces those risks and provides a gain in welfare, even apart from reductions in impoverishment that show up as increased GDP. This kind of improved welfare is most relevant for chapters dealing with the organization and financing of interventions. However, if the application of a disease-specific intervention is accompanied by changes in financing which also reduce financial risk, then authors are urged to estimate the corresponding welfare gains as part of a broader cost-benefit analysis.

6.3 Direct welfare gains from better health

Better health increases welfare, even if none of the gain is reflected in higher incomes. Authors may want to include rough estimates of these welfare gains, following the logic of Nordhaus (2003), Murphy and Topel (2003) and Jamison, Sachs and Wang (2001), for interventions that make particularly large contributions to life expectancy or quality of life.

7. Implementation of control strategies: lessons of experience

This section will address how widely (within and among countries) and successfully (with what outcomes and cost-effectiveness ratios) the interventions presented in the chapter have been applied. Whenever possible, please identify key factors which may have contributed to the successful implementation of the intervention(s). Authors also may wish to refer to "instructive failures"—where the attempt to apply the same intervention(s) in a different setting has not yielded similar positive results. Consider, for example, that if a strong primary health care system undergirds successful DOTS programs in tuberculosis control, then DOTS will succeed in some settings and may fail in others for reasons unrelated to the technical content of the tuberculosis program.

Wherever possible, this section should provide the following information on the program(s) identified:

- Nature of the intervention(s) and delivery system employed;
- Size of population covered and how scaling up was accomplished;
- Timeframe of implementation (start and end dates);
- Estimates of program costs (total, if a time horizon is specified, and/or annual) and cost-effectiveness;

- Estimates of impact; and
- Assessment of the program's sustainability.

Explanations or factors you may wish to consider include:

"Macro" political or economic factors affecting the external environment of the program—e.g. degree of political commitment on the part of government authorities; evidence of effective inter-agency coordination; the role of foreign aid (financial resources or technical assistance), etc.

"Micro" factors relating to program design and implementation—e.g. private sector participation; community involvement; whether the program was integrated with the public health care system; input from operations research, etc.

Findings in this section will be used, as appropriate, for the discussion of "success stories" in the book, which will examine a range of successful and unsuccessful examples of interventions taken to scale (i.e. full scale programs, not RCTs), and will draw conclusions about factors which may have contributed to successful (or failed) implementation.

8. Research and Development

The review of evidence concerning interventions will indicate where information is incomplete on the size and nature of the burden of disease, proportion of burden avertable in general and via specific interventions, resource requirements, and likely effectiveness of interventions on both health and non-health benefits. Authors are asked to assess where research would be most valuable, depending, among other things, on the size of the burden that is currently not avertable with known interventions. This section will also consider what research is needed to understand the variation in factors affecting the cost-effectiveness of implementation (as distinct from cost-effectiveness of an intervention in controlled trials). This can include basic epidemiological and economic research or more operational research on product development and improvement in service delivery.

A particularly important kind of research is evaluation of existing interventions. Too little is known about the costs, outcomes, or both, of many the tools currently in use. Especially where the intervention is already applied or likely to be applied at large scale and the available evidence is incomplete or contradictory, authors should consider what sort of evaluation would be most useful for policy choices.

9. Conclusions: Promises and Pitfalls

Authors should conclude each chapter with a summary of the different kinds of potential gains from greater and better (or less) application of the interventions considered, assess which ones show the most promise, and point out dangers or constraints to

implementation and any evidence on possible pitfalls in application, including negative health or non-health outcomes.

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Bibliography of suggested further reading

Briggs A. and Sculpher M. An introduction to Markov modelling for economic evaluation. In Mallarkey G (Ed) *Economic Evaluation in Healthcare*, Adis International, Aukland pp131-143 [Gives a worked example, with diagrams, of a Markov model and the data needed to populate the model.]

Barr N (1993). *The Economics of the Welfare State* (2nd edn.) Stanford University Press.

Briggs A (2000). Handling uncertainty in cost-effectiveness models. *Pharmacoeconomics* 17:479-500 [One of the most accessible papers covering probabilistic sensitivity analysis, moving to a presentation of cost-effectiveness planes.]

Cairns JA, Pol van der MM (1997) Saving future lives: a comparison of three discounting models. *Health Economics* 6:341-50.

Donaldson C, Mugford M, Vale L (eds) (2002) *Evidence-based Health Economics: From effectiveness to efficiency in systematic review* BMJ Books, London [Edited collection of papers critically reviewing use of published data in cost-effectiveness analysis, with several case studies set out.]

Donaldson D, Birch S, Gafni A (2002) The distribution problem in economic evaluation: Income and the valuation of costs and consequences of health care programmes *Health Economics*, 11, 1, 55-70 [This outlines, with a series of graphical examples, how the distribution of income impacts on the valuation of different health benefits, including additional life years gained and quality adjusted life years and skews resources towards the wealthier members of society.]

Drummond M, Pang F (2001) Transferability of economic evaluation results, Chapter 11 in Drummond M, McGuire A (eds.) (2001) *Economic Evaluation in Health Care: Merging theory with practice*, Oxford University Press [A methodological paper that discusses issues to consider when transferring cost data from one setting to another]

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Fenwick, E., Claxton, K., Sculpher, M. 2001, "Representing uncertainty: the role of cost-effectiveness acceptability curves", *Health Economics*, vol. 10,no. 8, pp. 779-787. [This goes further than the Briggs & Sculpher paper and develops cost-effectiveness acceptability curves on the basis of differing levels of decision makers' willingness to pay per unit of effect.]

Fox-Rushby J, Hanson K (2001) Calculating and presenting disability adjusted life years (DALYs) in cost-effectiveness analysis *Health Policy & Planning* 16, 3, 326-331 [Outlines step by step approach to calculating DALYs for use in cost-effectiveness analysis, including advice on presenting results and testing assumptions of DALYs]

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Jones-Lee MW (1994). Safety and the saving of life: the economics of safety and physical risk. In *Cost-Benefit Analysis* (ed. R. Layard and S Glaister), pp. 290-318. Cambridge University Press.

Karlsson G, Johannesson M. (1999) The decision rules of cost-effectiveness analysis. In: Mallarkey G (Eds.). *Economic Evaluation in Healthcare*. Adis International Limited, Hong Kong [Covers, with examples, how to establish whether interventions are subject to dominance and extended dominance and sets out why it is important to account for whether interventions are mutually exclusive or not. The most helpful aspect is a worked example showing how to select which interventions, with these characteristics, to fund - given a fixed budget or decision-makers' willingness to pay per quality adjusted life year gained.]

Kumaranayake L (2000) The real and the nominal? Making inflationary adjustments to cost and other economic data *Health Policy and Planning* 15, 2, 230-4 [This is a prescriptive paper showing why and how to adjust for inflation over time. It outlines the formula for conversion and uses a worked example with 3 countries.]

Layard R, Glaister S (1994). *Introduction*. In *Cost-Benefit Analysis* (ed. R. Layard and S Glaister), pp.1-56. Cambridge University Press.

Leslie J (1992). Women's time and the use of health services. *IDS Bulletin* 23:4-7.

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Tengs TO, Adams ME, Pliskin JS (1995). Five hundred life-saving interventions and their cost-effectiveness. *Risk Analysis* 15:369-90.

Tolley G, Kenkel D, Fabian R (eds.) (1994). *Valuing Health for Policy: an Economic Approach*. University of Chicago Press.

Walker D, Fox-Rushby JA. (2001) How to do (or not to do) … Allowing for uncertainty in economic evaluations: sensitivity analysis. *Health Policy and Planning*; 16(4): 435-443. [Outlines different types of sensitivity analysis. Focuses on all except probabilistic sensitivity analysis. Gives a step by step approach to how to justify and select variables and ranges for variable for use in sensitivity analysis and works through different examples.]

Walker D, Kumaranayake L (2002) Allowing for differential timing in cost analyses: discounting and annualisation. *Health Policy and Planning* 17, 1, 112-118 [This explains why discount rates are used and alternative methods of how to discount, with examples.]

Walker D, Mulligan J, Fox-Rushby JA (2003) Economic evaluation of health care interventions in developing countries: A critical review of the published literature, in *Progress in Economics Research,* Nova Science Publishers. [A systematic review of literature on the cost-effectiveness and cost-benefit of interventions to control communicable and non-communicable disease in low and middle-income countries up to 2001. It outlines what types of interventions have been evaluated where and critically reviews the methodological quality of each paper. Available from Damian.Walker@LSHTM.ac.uk.]

Walsh JA, Warren KS (1979). Selective primary care—an interim strategy for disease control in developing countries. *New England Journal of Medicine* 301:967-74.

Zeckhauser R, Shepard D (1976). Where now for saving lives ? *Law and Contemporary Problems* 40:5-45.

Websites and online guides

Apart from the databases (such as Medline, Cochrane Library, etc) there are two more specialised databases cataloguing and reviewing economic evaluations:

- The Economic Evaluations Database of the UK National Health Service (NHS EED). This is available free through http://nhscrd.york.ac.uk/nhsdhp.htm
- The Health Economic Evaluations Database (HEED) may be available on subscription through local libraries (or else see http://www.ohe-heed.com/)

Other more general databases that could prove useful include:

- Database of cost-utility analyses (to encourage standardisation and use of benchmarking – for a US focus) http://www.hsph.harvard.edu/cearegistry/
- *Health Technology Assessment*. A series of downloadable monographs evaluating the effectiveness and efficiency of specific health interventions in the UK. There is a particularly useful 'methods' section of papers available through http://www.ncchta.org/main.htm.
- Cochrane Economic Methods Group (discussion group for researchers on economic evaluation). Also gives notification of courses and conferences. http://www.uea.ac.uk/menu/acad_depts/hsw/hpp/healecon/ccemg.htm
- Commission on Macroeconomics and Health (several downloadable discussion papers summarizing evidence on cost-effectiveness of health interventions in low/middle income countries) http://www.cmhealth.org/

Annex 1: Characterization of World Bank regions

Authors are asked to indicate what interventions would be appropriate to recommend for a population of 1 million people in each region analyzed, and to estimate the cost-effectiveness of each intervention selected, at that scale. To facilitate this analysis, Table 1-1 provides a composite description of population dynamics, mortality and life expectancy, education levels, the prevalence or incidence of several risk factors and diseases, and information about the economy, for a population of 1 million people with representative age and sex distribution and other characteristics in each region.

Table 1-1 shows life expectancy only at birth; cost-effectiveness analysis will use regional life expectancy at various ages from birth up to age 80, which corresponds to the maximum expectancy assumed for males in high income countries. Tables 1-2 and 1-3 provide WHO estimates of life expectancy at 5-year intervals for each region, for all low and middle income countries together, and for the world as a whole.

Countries are classified as low income if the Gross National Income (GNI) per capita is less than $ 745 per year in 2001. Countries with GNI per capita more than $ 745 but less than $ 9,206 are classified as middle income. All the countries with GNI per capita above $ 9,206 are grouped together as high income, even though they are in different geographic regions. Table 1-4 classifies all countries by region and income level. Each of the geographically-defined regions includes at least one low income country and at least one middle income country.

The values of the variables were calculated using country data for the year 2001, published in World Bank *World Development Indicators 2003*, Washington, DC, unless otherwise indicated. (The exceptions are the WHO estimates of life expectancy by age and region, and the estimates of educational attainment.)

This annex was prepared by Nancy Hancock, DCPP; Tables 1-2 and 1-3 were provided by David Evans, World Health Organization.

Table 1-1 Composite Regional Profiles

	East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	High Income
Population dynamics				
Births				
Crude birth rate per 1,000 people	17	12	22	12
Number of births	17,000	12,000	22,000	
Total fertility rate (TFR)[1]	2.1	1.6	2.6	1.7
Deaths				
Crude death rate per 1,000 people	7	12	6	9
Number of deaths	7,000	12,000	6,000	9,000
Population				
Population growth rate (% p.a.)				
1980-2001	1.4	0.5	1.8	0.7
2001-2005 (projected)	0.8	0.0	1.3	0.3
Population age composition, %				
Age 0-14	27	21	31	18
Age 15-64	67	68	63	67
Age 65+	6	11	6	15
Urban population, (% of total)				
1980	21	59	65	73
2001	37	63	76	78
Mortality[2]				
${}_1q_0$, 1980, per 1,000 live births	53	43	61	12
${}_1q_0$, 2001, per 1,000 live births	34	30	28	5
${}_5q_0$, 1980, per 1,000	79	-----	84	15
${}_5q_0$, 2001, per 1,000	44	36	34	7
${}_{45}q_{15}$, 2001, per 1,000				
Males	184	317	221	128
Females	129	137	124	66
e_0, 2001 (years)	69	69	71	78
Education				
Years of schooling of population age 25 and over, whether studying or not[3]	5	9	8	11
Risk and Morbidity				
Smoking prevalence				
Males	63	56	40	36
Females	5	17	24	21

Table 1-1, continued

	East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	High Income
HIV prevalence	0.19	0.45	0.67	0.33
TB incidence	1,470	910	730	18
% low birth weight	9	7	10	7
Anemia prevalence in pregnant women	54	-----	35	-----
Child malnutrition[4]				
% of children under age 5, weight for age	15	-----	9	-----
% if children under age 5, height for age	14	-----	19	-----
Economy				
Economics				
GNI per capita	900	1970	3580	26,510
PPP GNI per capita	3790	6320	6900	26650
GDP growth rate 2000-01	5.5	2.3	0.4	0.7
GDP growth rate per capita 2000-01	4.5	2.3	-1.1	0.0
Poverty[5]				
% in poverty, <$1/day, 1990	30.5	1.4	11.0	-----
% in poverty, <$1/day, 1999	15.6	5.1	11.1	-----
% in poverty, <$2/day, 1990	69.7	6.8	27.6	-----
% in poverty, <$2/day, 1999	50.1	20.3	26.0	-----
Health expenditures				
% of GDP, 1997-2000	4.7	5.5	7.0	10.2
% public	38.6	72.4	47.6	62.2
% private	61.4	27.6	52.4	37.8

Table 1-1, continued

	Middle East and North Africa	South Asia	Sub-Saharan Africa
Population dynamics			
Births			
Crude birth rate per 1,000 people	26	26	39
Number of births	26,000	26,000	39,000
Total fertility rate (TFR)[1]	3.4	3.3	5.2
Deaths			
Crude death rate per 1,000 people	6	9	17
Number of deaths	6,000	9,000	17,000
Population			
Population growth rate (% p.a.)			
1980-2001	2.6	2.0	2.7
2001-2005 (projected)	1.8	1.4	1.9
Population age composition, %			
Age 0-14	36	35	44
Age 15-64	60	60	53
Age 65+	4	5	3
Urban population, (% of total)			
1980	48	22	21
2001	58	28	32
Mortality[2]			
${}_1q_0$, 1980, per 1,000 live births	94	115	118
${}_1q_0$, 2001, per 1,000 live births	44	71	71
${}_5q_0$, 1980, per 1,000	134	176	192
${}_5q_0$, 2001, per 1,000	54	99	171
${}_{45}q_{15}$, 2001, per 1,000			
males	193	252	520
females	143	202	461
e_0, 2001 (years)	68	63	46
Education			
Years of schooling of population age 25 and over, whether studying or not[3]	4	3	2
Risk and Morbidity			
Smoking prevalence			
Males	37	33	-----
Females	6	6	-----

Table 1-1, continued

	Middle East and North Africa	South Asia	Sub-Saharan Africa
HIV prevalence	0.10	0.64	8.36
TB incidence	64	190	354
% low birth weight	11	34	-----
Anemia prevalence in pregnant women	28	77	46
Child malnutrition[4]			
% of children under age 5, weight for age	15	53	-----
% if children under age 5, height for age	-----	47	-----
Economy			
Economics			
GNI per capita	2220	450	460
PPP GNI per capita	5430	2570	1750
GDP growth rate 2000-01	3.0	4.9	2.9
GDP growth rate per capita 2000-01	1.0	3.1	0.7
Poverty[5]			
% in poverty, <$1/day, 1990	2.1	45.0	47.4
% in poverty, <$1/day, 1999	2.2	36.6	49.0
% in poverty, <$2/day, 1990	21.0	89.8	76.0
% in poverty, <$2/day, 1999	23.3	84.8	74.7
Health expenditures			
% of GDP, 1997-2000	4.6	4.7	6.0
% public	61.9	20.8	42.4
% private	38.1	79.2	57.6

[1] Total fertility rate is defined as the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates.

[2] Mortality rate definitions are as follows: e_0 is life expectancy at birth calculated from the age-specific mortality rates of the indicated year. ${}_xq_y$ is the probability of dying in the x years following age y assuming survival to age y, again calculated from the age-specific mortality rates of the indicated year.

[3] Source: Cohen D & Soto M. (2001). OECD Development Center Technical Papers No. 179: Growth and human capital- good data, good results. For the Middle East and North Africa, Tunisia was selected as the representative country for education data because its GNI ($2,070) is similar to the region's GNI ($2,220). For South Asia, India was selected because its GNI ($460) is similar to the region's GNI ($450). For Sub-Saharan Africa, Angola was selected because its GNI ($500) is similar to the region's GNI ($460). For High Income Countries, the Netherlands was selected because its GNI ($24,330) is similar to the region's GNI ($26,510). The data are for the year 2000.

[4] According to the *World Development Indicators 2003*, prevalence of child malnutrition is the percentage of children under five whose weight for age and height for age are more than two standard deviations below the median for the international reference population ages 0-59 months. The reference population, adopted by the WHO in 1983, is based on children from the United States, who are assumed to be well-nourished.

[5] Population below $1 a day and population below $2 a day are defined as the percentages of the population living on less than $1.08 a day and $2.15 a day in 1993 international prices (equivalent to $1 and $2 in 1985 prices, adjusted for purchasing power parity) according to the *World Development Indicators 2003*.

Table 1-2: Life expectancy by age, by region - Males

Age	World	High income	All Low and middle income	EAP	ECA	LAC	MNA	SAR	SSA
0	63.43	75.20	61.41	67.58	63.39	67.46	66.90	61.44	44.46
1	66.47	74.66	64.67	69.26	64.32	68.65	69.02	65.59	48.73
5	64.01	70.80	62.31	65.90	60.82	65.15	65.91	63.00	48.41
10	59.49	65.87	57.83	61.19	56.05	60.40	61.27	58.43	44.51
15	54.82	60.93	53.18	56.39	51.29	55.59	56.50	53.72	40.28
20	50.33	56.11	48.72	51.73	46.78	50.96	51.84	49.16	36.40
25	46.00	51.38	44.42	47.15	42.54	46.46	47.24	44.72	33.00
30	41.67	46.65	40.13	42.52	38.28	41.92	42.59	40.23	30.16
35	37.36	41.88	35.88	37.89	34.06	37.37	37.94	35.73	27.95
40	33.05	37.15	31.64	33.31	29.93	32.89	33.35	31.29	25.57
45	28.83	32.52	27.49	28.85	25.94	28.52	28.87	26.96	23.11
50	24.73	28.02	23.45	24.56	22.10	24.33	24.57	22.83	20.45
55	20.83	23.75	19.63	20.52	18.50	20.37	20.52	18.99	17.51
60	17.18	19.67	16.06	16.79	15.09	16.71	16.79	15.45	14.51
65	13.89	15.86	12.85	13.40	12.15	13.39	13.39	12.22	11.71
70	10.93	12.37	9.97	10.37	9.49	10.44	10.36	9.35	9.27
75	8.44	9.25	7.55	7.78	7.30	7.93	7.77	6.90	7.36
80	6.45	6.71	5.60	5.67	5.57	5.91	5.66	4.87	5.96

Table 1-3: Life expectancy by age, by region - Females

Age	World	High income	All Low and middle income	EAP	ECA	LAC	MNA	SAR	SSA
0	67.50	81.50	64.80	71.07	72.64	74.03	69.77	63.06	45.86
1	70.13	80.89	67.59	72.19	73.30	74.80	71.26	66.37	49.93
5	67.68	77.02	65.23	68.75	69.77	71.23	68.06	63.71	49.63
10	63.12	72.06	60.70	63.96	64.95	66.42	63.34	59.09	45.67
15	58.41	67.10	56.00	59.11	60.07	61.55	58.54	54.39	41.35
20	53.88	62.18	51.50	54.35	55.25	56.73	53.81	49.84	37.57
25	49.52	57.27	47.19	49.64	50.48	51.94	49.13	45.46	34.53
30	45.22	52.38	42.95	44.95	45.73	47.16	44.47	41.12	32.19
35	40.94	47.51	38.74	40.28	41.01	42.41	39.84	36.79	30.36
40	36.60	42.67	34.46	35.67	36.36	37.72	35.27	32.50	27.93
45	32.26	37.89	30.19	31.14	31.79	33.10	30.78	28.24	25.17
50	27.97	33.19	25.96	26.73	27.35	28.61	26.42	24.07	22.01
55	23.79	28.59	21.86	22.50	23.07	24.26	22.24	20.07	18.59
60	19.80	24.10	17.96	18.46	18.95	20.09	18.24	16.27	15.23
65	16.07	19.76	14.32	14.70	15.15	16.16	14.52	12.80	12.13
70	12.69	15.60	11.07	11.31	11.68	12.58	11.19	9.75	9.39
75	9.76	11.76	8.29	8.42	8.73	9.46	8.33	7.19	7.16
80	7.19	8.45	6.03	6.09	6.33	6.86	6.03	5.20	5.33

Table 1-4. Countries classified by region and income level

East Asia and Pacific (EAP)

Low income

Cambodia
Indonesia
Korea, Dem. Rep.
Lao PDR
Mongolia
Myanmar
Papua New Guinea
Solomon Islands
Timor-Leste
Vietnam

Middle income

American Samoa
China
Fiji
Kiribati
Malaysia
Marshall Islands
Micronesia, Fed. Sts
Palau
Philippines
Samoa
Thailand
Tonga
Vanuatu

Europe and Central Asia (ECA)

Low income

Armenia
Azerbaijan
Georgia
Kyrgyz Republic
Moldova
Slovak Republic
Tajikistan
Ukraine
Uzbekistan

Middle income

Albania
Belarus
Bosnia and Herzegovina
Bulgaria
Croatia
Czech Republic
Estonia
Hungary
Isle of Man
Kazakhstan
Latvia
Lithuania
Macedonia, FYR
Poland
Romania
Russian Federation
Turkey
Turkmenistan
Yugoslavia, Fed. Rep

Latin American and Caribbean (LAC)

Low income

Haiti

Middle income

Antigua and Barbuda
Argentina
Barbados
Belize
Bolivia
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominica
Dominican Republic
Ecuador
El Salvador
Grenada
Guatemala
Guyana
Honduras
Jamaica
Mexico
Nicaragua
Panama
Paraguay
Peru
Puerto Rico
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Suriname
Trinidad and Tobago
Uruguay
Venezuela, RB

Table 1-4, continued

Middle East and North Africa (MNA)	South Asia (SAR)	Sub-Saharan Africa (SSA)	High income
Low income	***Low income***	***Low income***	Andorra
Yemen	Afghanistan	Angola	Aruba
Middle income	Bangladesh	Benin	Australia
Algeria	Bhutan	Burkina Faso	Austria
Djibouti	India	Burundi	Bahamas, The
Egypt, Arab Rep.	Nepal	Cameroon	Bahrain
Iran, Islamic Rep.	Pakistan	Central African Republic	Belgium
Iraq	***Middle income***	Chad	Bermuda
Jordan	Maldives	Comoros	Brunei
Lebanon	Sri Lanka	Congo, Dem. Rep.	Canada
Libya		Congo, Rep.	Cayman Islands
Malta		Côte d'Ivoire	Channel Islands
Morocco		Equatorial Guinea	Cyprus
Oman		Eritrea	Denmark
Saudi Arabia		Ethiopia	Faeroe Islands
Syrian Arab Republic		Gambia, The	Finland
Tunisia		Ghana	France
West Bank and Gaza		Guinea	French Polynesia
Yemen, Rep.		Guinea-Bissau	Germany
		Kenya	Greece
		Lesotho	Greenland
		Liberia	Guam
		Madagascar	Hong Kong, China
		Malawi	Iceland
		Mali	Ireland
		Mauritania	Israel
		Mozambique	Italy
		Niger	Japan
		Nigeria	Korea, Rep.
		Rwanda	Kuwait
		São Tomé and Principe	Liechtenstein
		Senegal	Luxembourg
		Seychelles	Macao, China
		Sierra Leone	Monaco
		Somalia	Netherlands
		Sudan	Netherlands Antilles
		Swaziland	New Caledonia
		Tanzania	New Zealand
		Togo	Northern Mariana Islands
		Uganda	Norway
		Zambia	Portugal
		Zimbabwe	Qatar

Table 1-4, continued

Sub-Saharan Africa (SSA)	**High Income**
Middle income	San Marino
Botswana	Singapore
Cape Verde	Slovenia
Gabon	Spain
Mauritius	Sweden
Mayotte	Switzerland
Namibia	Taiwan, China
South Africa	United Arab Emirates
	United Kingdom
	United States
	Virgin Islands (U.S.)

Annex 2: Calculations of DALYs from natural units

The natural units from which Disability-Adjusted Life Years (**DALYs**) are constructed, whether for estimating burden of disease or the effectiveness of an intervention, are:

the number of people suffering death or disability from a particular cause during one year (incidence);

the age(s) at which death or disability occurs; and

in the case of disability which is not life-long, the duration of the disability.

Two intermediate measures are constructed from these:

(1) Years of life lost (**YLL**), which for an individual is estimated from a normative loss function, using the Model West life table with **LE(0)**, life expectancy at birth, set at 80 years for men and 82.5 years for women. The life table yields a life expectancy at the age at death, **LE(a)**. For a population, this measure is added up over all the individuals who die at age **a**, over all the ages at which deaths occur:

$$\mathbf{YLL(pop)} = \sum_{\mathbf{a}} \mathbf{N(a)YLL(a)}$$

Where **N(a)** is the number who die at age **a**, each of whom loses **YLL(a)** years of life. (If **N(a)** is expressed as a rate, e.g., per 100,000 population, then **YLL(pop)** is the number of life years lost per 100,000 people.)

(2) Years lived with disability (**YLD**), which for an individual is just the length or duration of the disability, **L(a)**, starting at age **a**, the age of onset. If the disability lasts the rest of the person's expected life, then **L(a) = LEj(a)**, remaining life expectancy at that age for people with that disability (**j**). This measure is added up over a population according to the numbers of people suffering the onset of disability at age **a**, for all ages, as for **YLL(pop)**.

Both **YLL** and **YLD** are measured in calendar years. The only subjective parameter choice involved in their calculation is that of **LE(0)**, which can be set equal to the highest national values observed (80 years at birth for men and 82.5 for women) or to the (lower) regional estimated life expectancy. The consequences of choosing one value or the other are discussed in the text; Annex tables 1-2 and 1-3 provide estimated regional life expectancies by age and sex. DCPP will follow the former choice ($\geq$ 80 years) for estimating the burden of disease, and the latter--regional age-specific values of **LE(a)--** when estimating the effectiveness of interventions. Annex 7 discusses how the choice of life expectancy affects estimates of averted and avertable burden of disease.

To go from **YLL** and **YLD** to **DALYs**, two transformations are required.

First, **YLD** due to disease or condition **j** are multiplied by the corresponding disability weight **D(j)**: this converts years with disability into equivalent years of life lost, **YLD(equiv, j) = D(j)YLD(j).** If a particular disease is associated with several different degrees of severity—for example, hookworm may lead to mild, moderate or severe anemia—or with several different disability sequelae, as in the case of malaria, then the total disability contribution is found by summing over all the specific conditions or sequelae, each multiplied by the number of people affected:

Total disability, in equivalent years of life lost, $\mathbf{YLD(equiv) = \sum_j N(j)D(j)YLD(j)}$, where **YLD(j)** includes the sum over all ages of onset of the sequela **j**, as above.

Second, both **YLL** and **YLD(equiv)** are discounted at the constant rate **r** per annum from age **a** out to **LE(a)**, for death or lifetime disability; or for the **L(a)** years that a short-term disability lasts. With this adjustment, both years of life lost and years lived with disability cease to correspond to a sum of calendar years and become the net present value of a future stream of life, measured in **DALYs**. Discounting takes the form

$\mathbf{\sum^{t = LE(a)}_{t=0} (1 + r)^{-t}}$**;** each year from age **a** to age **LE(a)**—or over the interval

L(a) for

disabilities that do not last a lifetime—is multiplied by $\mathbf{(1 + r)^{-1}}$ compared to the year before. Expressing the discounting in the form of an integral rather than a sum leads to the simpler expression

$$\mathbf{DALYs(mortality\ at\ age\ a) = \{\frac{1 - e^{-r^*[LE(a) - a]}}{r^*}\} < YLL(a)}$$, and similarly for

DALYs(disability at age a), where **LE(a) – a** for lifetime disability is replaced by **L(a)** for disability of shorter duration, and **YLL(a)** is replaced by **YLD(equiv, a).**

When going from the discrete formulation to the integral, the discount rate changes slightly so as to keep the value of the sum or integral the same. For an infinite stream, the discrete sum is

$\mathbf{(1 + r)/r}$, while the integral is $\mathbf{1/r^*}$, so $\mathbf{r^* = r/(1 + r)}$. For finite streams, the relation between **r** and $\mathbf{r^*}$ depends on the length of the stream.

Both expressions (for **YLL** and for **YLD**) are summed over all ages of onset and that for disability is also summed over all the relevant disability weights. Discounting reduces the apparent number of years lost to death or disability, the reduction being greater as the interval is longer.

Total **DALYs** are then the sum of the component due to mortality and that due to disability. The final **DALY** measure incorporates three subjective choices: of life

expectancy **LE(a)**, the disability weights **D(j),** and the discount rate **r** or **r***. Although the "**Y**" in **DALY** stands for years, these units do not treat all years equally. They value years with disability less than years lost to death, and value each year less as it is farther off in the future.

The calculations described here are performed automatically when data on numbers of people affected at each age, life expectancy, the discount rate, and the duration and severity of disability, are entered into WHO spreadsheets. Given data or choices on those variables, authors will not actually have to calculate **DALYs** step by step as shown here. Instead, authors will receive model spreadsheets for making their own calculations from data on incidence and severity.

Note: a more detailed description of DALYs and the logic of their construction, including the effect of age-weighting, is given in Christopher JL Murray (1996). "Re-Thinking DALYs", in *The Global Burden of Disease*. Geneva and Boston: Harvard University Press for the World Health Organization and the World Bank. Philip Musgrove (2000). "A Critical Review of 'A Critical Review': the Methodology of the 1993 World Development Report, 'Investing in Health'", *Health Policy and Planning* 15, explains DALYs and some of the misconceptions about their construction and use.

Annex 3. Discounting in burden of disease and cost-effectiveness analysis

The starting point for the DCPP analysis is the discussion of discounting in Gold *et al.* (1996, chapter 7), which concludes in favor of—

using a constant-rate (exponential) function, which implies that the ratio of present values of either costs or benefits in two future years is independent of the year to which they are being discounted (stationary time preference);

discounting future costs and health outcomes at the same rate;

setting a rate corresponding to relatively risk-free investments, but not necessarily to pure time preference, in the range of 2.5 to 5% per year; and

using the same rate (set at 3%) for all analyses, independently of the nature of the intervention considered or the potential beneficiary population.

Because there is still controversy and less than full professional consensus on these choices, particularly as to their application to poorer countries, a workshop was organized by Resources for the Future to address four specific questions posed by the DCPP editors. This Annex is based partly on the summary report of that workshop (Resources for the Future, 2003). The questions are:

1. Are there good reasons to deviate from the constant discount rate of 3% per year recommended by Gold and colleagues that is routinely used in evaluating health interventions in the United States?

2. If there are good reasons to use an alternate discounting procedure (presumably, one that discounts at a non-constant rate declining through time), which procedure(s) would be appropriate?

3. Should health be discounted differently than other social sector projects?

4. Should a different discounting rate and/or procedure be used for developing countries? If so, should more than one rate or procedure be used, depending on income or other variables?

There are two circumstances under which constant discounting may appear to undervalue the future. One is that the consequences of what happens today may endure a long time into the future; any constant rate much above zero will then give almost no weight to distant consequences. This consideration may apply to estimates of the burden of disease, for deaths at early ages that imply the loss of many decades of life, or early incidence of permanent disability that lasts for the rest of life and does not hasten death. Similarly, it applies to cost-effectiveness analysis for all interventions that avert death or chronic disability at very early ages. To the extent that an intervention protects future generations, the effect may last even beyond the lifetime of the initial beneficiary. Thus

some interventions to protect maternal and fetal health may have consequences extending well beyond the mother's lifetime. Interventions directed to protecting the environment may have even longer-lasting health effects. Recent work by Newell and Pizer (forthcoming), suggests that a non-constant discounting procedure would not make more a 5-20% difference in the net present value of benefits and costs, over the 30 to 50 year decision making horizons that apply to most interventions in DCPP, than if a constant discount rate were to be used. Based on this information, workshop participants agreed that using a constant discount rate for all or nearly all interventions would be appropriate.

The second case arises when an intervention today begins to take effect only after a long interval, during which discounting will reduce the importance of the time after which the effect occurs. This situation does not apply to the burden of disease, which is based on incidence and therefore starts counting the effects of mortality and disability immediately. Neither does it apply to any intervention that deals with a current disease or condition, or a condition likely to appear in the near future. It is therefore not a problem for any clinical intervention, nor for many preventive interventions. A small number of interventions, however, are designed to prevent health loss that would be manifest only after several decades. Immunization in infancy against hepatitis B, to reduce the risk of liver cancer after age 40 or 50 is an example; it is quite different in this respect from immunization against polio or measles. Investment in research and development, in particular, may bear fruit only long after the start of costs.

For the few interventions where the costs and benefits are likely to be observed over time horizons of 100 years or more, or where there is a lag of several decades between the costs of the intervention and the beginning of the benefit stream, it was recommended that authors be encouraged to check the sensitivity of their results to the application of a non-constant discount rate (declining or "slow", compared to exponential discounting). Based on recent research on several families of discount functions (Jamison and Jamison, 2003), DCPP will recommend a particular function, probably a one-parameter member of the hyperbolic family which is the fastest of a group of slow functions, to use in those cases.

There was consensus that investments in health should not be discounted differently from other projects. Further, it was recommended that other factors that influence the rate of discounting such as uncertainty in future costs and benefits and risk aversion should be dealt with separately from the pure discount rate. In this regard, chapter authors are encouraged explicitly to take uncertainty into consideration while discounting for specific interventions. So long as the analysis uses a constant rate and deals with only short lags between costs and outcomes, there is usually no need to introduce uncertainty. When uncertainty does matter because of very long horizons, at slow discounting becomes appropriate.

There was disagreement among workshop participants about whether the 3% risk-free discount rate that is used in the United States is an appropriate rate to use in developing countries. A number of participants felt that the rate should be at least somewhat higher for developing countries given their (probably) higher real risk-free cost of capital.

Taking this into consideration, it was recommended that two rates be used; a base rate of 3% and a higher rate of 6% for all the analyses, since the focus of DCPP is interventions implemented in developing countries. Participants did not favor using a lower rate in higher income countries and a lower rate in lower income countries, as that would systematically make many interventions appear less cost-effective in poorer settings. (The use of regional life expectancies in cost-effectiveness analysis already has that effect, as described above in section 4.3.)

The issue of pure rate of time preference was not discussed in much detail at this workshop. Although there is some evidence to suggest that this rate is probably high in developing countries relative to developed countries (for example, Poulos and Whittington, 2000), considerations of inter-generational equity may require that it be set at zero. For the purposes of DCPP, the pure rate of time preference was assumed to be very low and close to zero, and the discount rate taken instead from the return on risk-free investments.

References

Jamison DT, Jamison JS (2003). *Discounting*. DCPP Working Paper No. 4. Bethesda, MD: Disease Control Priorities Project, Fogarty International Center, National Institutes of Health, March.

Newell RG, Pizer WA (forthcoming). Discounting the distant future: how much do uncertain rates increase valuations? *Journal of Environmental Economics and Management,*

Poulos C, Whittington D (2000). Time preferences for life-saving programs: evidence from six less developed countries. *Environmental Science and Technology* 34:1445-55.

Resources for the Future (2003). Summary of RfF Workshop in Discounting for Health in Developing Countries. Washington, DC: Resources for the Future, 19 May.

This annex was prepared by Ramanan Laxminarayan, Resources for the Future, and Philip Musgrove, DCPP.

Annex 4. Judging the quality of evidence about health interventions

Authors are encouraged to classify interventions according to the quality of evidence available concerning them, using the following three-way distinction :

Level A	Randomized controlled trials or systematic overviews of trials.
Level B	Nonrandomized studies with careful multivariate analyses (e.g., Cox regression analyses or Kaplan Meier survival analyses)
Level C	Case series or studies or expert opinion (i.e. without careful multivariate analyses)

There are no strict rules, but exercising judgment about the level of evidence is required. For example, studies dealing with infectious disease transmission often have to rely on mathematical modeling of transmission and its relationship to the underlying epidemiological context. An overview of several dozen price-elasticity studies for smoking might arguably be considered level A evidence.

One small trial from one site should not be considered as reliable as several trials from various settings. Judgment is also needed as to whether intervention trials conducted in developed countries are applicable to low-income countries. For example, randomized trials of aspirin for treatment of acute myocardial infarction should be applicable worldwide, as the underlying biological event (clotting of the coronary arteries) is similar in different settings. In contrast, randomized trials of particular infectious disease antigen (e.g. rotavirus subtypes) may have different results across countries.

For the most part, evidence of interventions in DCPP will be level B or C. It is important for authors to try to separate these as much as possible.

Several interventions that are commonly provided (e.g. acute treatment for asthma) are basically standard of care worldwide, for which these levels simply do not apply. In this case, we recommend you code these as level C evidence.

For further reading

1. Cook DJ, Guyatt GH, Laupacis A, Sackett DL, Goldberg RJ (1995). Clinical recommendations using levels of evidence for antithrombotic agents. *Chest* 108(4 Suppl):227S-230S Available online at: http://www.chestjournal.org/cgi/reprint/108/4/227S.pdf

This article discusses a particular subject (blood thinners for cardiovascular disease), but the methods for grading quality of evidence constitute the important part of the paper. It is also short—only 4 pages.

2. Guyatt GH, Haynes RB, Jaeschke RZ, Cook DJ, Green L, Naylor CD, Wilson

MC, Richardson WS. Users' Guides to the Medical Literature: XXV (2000). Evidence-based medicine: principles for applying the Users' Guides to patient care. Evidence-Based Medicine Working Group. *Journal of the American Medical Association* 284(10):1290-6. Online at http://jama.ama-assn.org/cgi/reprint/284/10/1290.pdf

A longer article with more detail. This is a part of series in JAMA on how to use medical literature.

This annex was prepared by David Naylor, University of Toronto and Amardeep Thind, University of California at Los Angeles

Annex 5: Description and classification of interventions

The analysis of interventions, including cost-effectiveness analysis, is the core of DCPP. Authors are asked to list all the interventions to be discussed in each chapter, to describe them (including a specification of the appropriate level of aggregation) and to classify them on various dimensions, including that of the nature of evidence concerning their effectiveness and cost-effectiveness as described in Annex 4. The DCPP criterion for selecting interventions is to emphasize those that—

--are known, or considered likely, to be highly cost-effective and therefore to be recommended for implementation or expansion;

--are being, or likely to be, implemented on a substantial scale or causing a substantial expenditure, whether or not there is evidence that they are const-effective, perhaps because of political or financial pressures to apply them. Such interventions therefore should be examined with whatever evidence can be gathered, and possibly recommended against; or

--are being implemented despite evidence that they are ineffective or even harmful to health on balance and should therefore definitely be discouraged or eliminated.

This annex includes—

--a worksheet for *each chapter* on which to list all the interventions treated there, indicating which of the distinctions listed above is important for inclusion (5.1); and

--a worksheet for *each intervention* on which to describe it more fully than on the chapter list and to classify it according to a number of other dimensions, including its type, objective, difficulty of implementation and the policy instruments that are relevant for applying it (5.2). The number of these will vary from chapter to chapter.

--definition of an intervention and of the several properties by which it should be classified (5.3). Table 5-1 provides additional definition for the classification of clinical interventions according to locus and mode of delivery

The information derived from these worksheets will, in addition to guiding the analysis in each chapter, provide a basis for cross-reference among chapters, when the same intervention is relevant to several chapters but the cost-effectiveness analysis is conducted in only one place in the volume. It will also facilitate analysis of groups of interventions with common objectives, characteristics or policy instruments.

5.1 Chapter worksheet: list of interventions, indicating where possible the nature of evidence about their cost-effectiveness or their importance: interventions that are attractive because they are known to be or appear likely to be highly cost-effective; interventions with no evidence, or doubtful evidence of cost-effectiveness, that are nonetheless likely to be implemented because of political, financial or other pressures and which need to be evaluated; and interventions for which there is clear evidence of ineffectiveness or no benefit, including evidence of harm when implemented

Chapter _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Etc.

5.2 Intervention worksheet describing each intervention listed on 5.1 and discussed in the chapter (whether the cost-effectiveness analysis is performed in that chapter or in another chapter)

1. Name of technical intervention and conditions or risk factors addressed:

   (1.1) Intervention name

   _____

   (1.2) Conditions or risk factors addressed

   _____

2. Chapter where discussed at length:

   _____

3. Other chapters for which the intervention is relevant:

   _____

   _____

4. Closely related interventions:

   _____

   _____

   _____

5. Chapter author and economist(s) responsible for developing (or reporting) the analysis of the intervention CEA:

   _____

   _____

6. Is intervention included in WHO-CHOICE analyses? [For Secretariat use only: How can this be accessed from the WHO-CHOICE intervention analyses?]

   _____

   _____

Characterization of the Intervention

7. Brief description of intervention:

   (7.1) Does the intervention principally involve change in the scale of application of ongoing activities? (e.g. expanding immunization coverage rates?) If so, to what level and from what level?

   _____

   _____

   (7.2) Does the intervention principally involve introduction of new activities (perhaps in conjunction with ongoing activities, e.g. the addition of Hib and HepB to the routine immunization schedule)? If so, what is being added and in what context?

   _____

   _____

8. Objective(s) of intervention (see Companion Guide Section I): _____

   Choose from the following (possibly more than one):

   A. Population based preventive interventions
      - A.1 personal behavior change;
      - A.2 control of environmental hazards; or
      - A.3 population-oriented medical interventions.

   B. Personal interventions
      - B.1 primary prevention;
      - B.2 cure;
      - B.3 acute management;
      - B.4 secondary prevention;
      - B.5 rehabilitation; or
      - B.6 palliation.

9. For personal interventions, choose one or more from List A and from List B (see Companion Guide Section II for more detail): _____

   A. Personal interventions – level of care
      - A.1 home (providing simple medical care);
      - A.2 primary care level (e.g. private provider's office or a community, school or workplace clinic or a health post; indicate whether the provider need be a physician or not);
      - A.3 local hospital or mid-level facility (sometimes identified as a district hospital), providing both inpatient and outpatient care;
      - A.4 referral hospital or high-level facility, providing complex medical and surgical care and support to lower-level facilities.

B. Personal interventions – therapeutic model
   B.1 relies on drugs or immune enhancement;
   B.2 relies on surgery or other interventional procedures;
   B.3 relies on physical or psychological therapy.

10. Does intervention typically require diagnostic procedures? _____If yes, is it a laboratory or an imaging procedure?

_____

11. Describe relevant instruments of policy:

_____

_____

Policy instruments are the activities that can be undertaken by governments (or other entities) to encourage adoption of a technical intervention. Please choose one or more from the following:

A. information, education and communication to individuals or service providers;
B. quality enhancement activities;
C. economic incentives (taxes; subsidies; establishment of property rights)
D. regulations and legislation;
E. finance (or mandate to finance) of service; and
F. changing engineering design (e.g. by construction of speed bumps).

12. Quality of the evidence _____

Choose from the following, (as described in Companion Guide Section III):

A. Randomized controlled trials (be clear about subjective assumptions required for generalization to non-study populations)
B. Non randomized studies with careful multivariate analyses and well-defined endpoints (e.g. Cox regression analyses or careful mathematical modeling for infectious diseases)
C. Case series or expert opinion (include here interventions commonly done as part of routine practice worldwide for which no type A or type B evidence exists).

Economic analysis of Intervention

13. Has cost-effectiveness analysis been presented in the chapter draft for each intervention? Yes _____ No _____. Elsewhere in DCP-2? Yes _____ No_____ If yes, which chapter(s)? _____

14. Has cost-effectiveness analysis for each intervention been done by World Bank

regional groupings? (Low- and Middle-Income Countries: East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa; High Income, World).
Yes _____ No _____

15. Has cost-effectiveness analysis been done in PPP$ per DALY averted?
Yes _____ No _____

16. Has cost-effectiveness analysis for each intervention been conducted for DALYs averted per year per population of 1 million? Yes _____ No _____

17. Externalities:

(17.1) Describe possible positive externalities of the intervention (e.g. interruption of infectious disease transmission):

_____

_____

(17.2) Describe possible negative externalities (e.g. pressure for evolution of drug-resistant pathogens or disinhibitory results of use of ARVs):

_____

_____

18. Describe possible public goods element of intervention (e.g. public service advertising for use of ORT or smoking cessation):

_____

_____

19. Describe returns to scale: Are there levels of (incremented) intervention coverage associated with important fixed costs or scale economies? And/or increasing marginal costs?

_____

_____

20. What are main factors influencing variation in intervention cost-effectiveness (e.g. aspects of the epidemiological environment, individual characteristics, or system characteristics)? [See Companion Guide Section IV.]

_____

_____

21. What are the major reasons for the remaining disease burden? [See Companion Guide Section V.]

_____

_____

_____

22. Provide brief summary of cost-effectiveness analysis:

_____

_____

_____

23. Describe non-health outcomes of intervention (if any):
(e.g. reduced destruction of vehicles from road safety interventions; amenity value of clean air; demographic value of family planning programs; reduced family and neighbor distress from use of antipsychotics for Alzheimer's) [See Companion Guide Section VI.]

_____

_____

24. Describe non-financial costs of intervention: institutional capacity

_____

Interventions vary in the technical, administrative and financial management demands they place on health systems. Immunization programs, for example, place (relatively) low demands; subsidizing physicians to correctly implement DOTS for TB places greater demands; and design and implementation of health sector reforms place still greater demands. Please provide a rough judgment of:

A. low
B. medium
C. high
D. very high.

25. Describe non-financial costs of intervention: welfare loss

_____

_____

List potential welfare losses to the patient associated with the intervention such as common side effects of medication or loss of pleasures associated, for examples, with stopped smoking or with having protected sex.

26. Describe non-financial costs of intervention: risks to health

_____

_____

_____

List risks posed by the intervention—mortality, chronic or temporary disability—and estimate how frequently they occur as a share of recipients.

27. Describe non-financial costs of intervention: household time

_____

_____

The costs of provider time will (usually) be reflected in financial costs of intervention, but time costs to patients or families needs to be considered as well – both to get a sense of overall social costs and to understand incentives affecting uptake of interventions. (Examples include transportation time to and waiting time for providers, and time spent fetching water, time spent by mothers breastfeeding).

28. Provide brief summary of cost-benefit analysis (if any):

_____

_____

_____

_____

_____

Table 5.1: Personal interventions: level of delivery and mode of intervention

Level of delivery	Typical conditions addressed	Intervention mode			
		Diagnostic	Therapeutic		
			Medical	Surgical	Physical or psychological therapy
Home	Minor trauma, simple infections, support of population-based interventions, family planning	Symptomatic	Over-the-counter drugs	Not applicable	Not applicable
Clinic (private, community, or school or work-based; may or may not require a physician)	Minor trauma, simple infections, support of population-based interventions, uncomplicated childbirth, family planning	Symptomatic	Short list of essential drugs (about 20)	Sutures	Supervising physical therapy
Local or district hospital (mid-level facility)	Complicated childbirth, fractures, burns, complicated infections, cataract, hernia, appendectomy, diabetes, hypertension	Symptomatic, basic laboratory, basic radiology	Long list of essential drugs (about 200)	Many fractures, Caesarean sections, abdominal and some rehabilitative surgery	Complex physical and psychological therapy
Referral hospital (high-level facility)	More complicated medical and surgical conditions, including cancers	More advanced laboratory and radiology	Also specialized drugs, chemo- and radiotherapy	Also more complex surgery of head and chest	Support to local hospitals

This table was prepared by Dean Jamison and Sonbol Shahid-Salles, DCPP.

5.3 Definition of terms

1. **Intervention Categories**

The term 'intervention' is used to denote actions taken by or for individuals to reduce the risk, duration, or severity of an adverse health condition. Interventions are the proximal cause of deliberate changes in risks, duration, or severity. Instruments of policy (see below) encourage, discourage, or undertake interventions. Stopping smoking, for example, is an intervention that an individual can take to reduce risk from a range of diseases; taxing tobacco products is a potential instrument of government policy to encourage this intervention. Interventions are divided into those that are 'population based' and those that are 'personal'.

1. **Population based primary prevention** are sought for or directed toward entire populations or population subgroups. These interventions fall into three broad categories:
   1.1 **personal behavior change**;
   1.2 **control of environmental hazards**; or
   1.3 **population-oriented medical interventions** (e.g., immunization, mass chemoprophylaxis, and screening and referral).

2. **Personal interventions** are directed to individuals and can be provided at home, at clinics (community, private, work-based, or school-based), at district hospitals, or at referral hospitals.

   2.1 **Primary prevention** aims to reduce the level of one or more identified risk factors in order to reduce the probability of the initial occurrence of a disease (e.g. medication for established hypertension to prevent stroke or MI).

   2.2 **Cure** of a condition aims to remove its cause and restore function to the *status quo ante.*

   2.3 **Acute management** consists of time-limited interventions that decrease the severity of acute events or the level of established risk factors to minimize their long-term effect (e.g. thrombolytics for acute MI or angioplasty to reduce stenosis in coronary arteries).

   2.4 **Secondary prevention** (or chronic care) consists of ongoing interventions aimed at decreasing the severity and frequency of recurrent events of chronic or episodic diseases (e.g. SSRIs for severe unipolar depression).

   2.5 **Rehabilitation** aims to restore (or partially restore) physical, psychological, or social function resulting from a previous condition.

2.6 **Palliation** aims to reduce pain and suffering from a condition for which no means of cure or rehabilitation is currently available (this may range from the use of aspirin for headaches to the use of opiates to control terminal cancer pain).

2. **Instruments of policy**

These are the activities that can (potentially) be undertaken by governments or other entities that wish to encourage or discourage interventions, or, importantly, to expand the menu of potential intervention. Five major instruments or policy are distinguished.

2.1 Use of **information, education, and communication** seeks to improve the knowledge of individuals (and service providers) about the consequences of their choices.

2.2 Use of **taxes and subsidies** on commodities, services, and pollutants seeks to effect appropriate behavioral responses.

2.3 Use of **regulation and legislation** seeks to limit availability of certain commodities, to curtail certain practices, and to define the rules governing finance and provision of health services.

2.4 Use of **direct expenditures** seeks to provide (or finance provision of) selected interventions (e.g. immunizations), to provide infrastructure (e.g. medical schools) that facilitates provision of a range of interventions, or altering infrastructure so as to influence behavior (e.g. installing speed bumps, or removing the handle of the Broad Street pump).

2.5 Undertaking **research and development** (or encouraging them through s subsidies) is an instrument central to the goal of expanding the range of interventions available and reducing the cost.

* The *Dictionary of Epidemiology* (Last 1988) provides a helpful discussion of different types of prevention but, interestingly, has no entries for 'cure' or 'rehabilitation'. Their term 'tertiary prevention', which is not used here, seems to encompass both 'rehabilitation' and 'palliation', as those terms are defined here.

Source: Jamison, D (2002). "Cost-effectiveness analysis: concepts and applications." *Oxford Textbook of Public Health***.** Oxford University Press.

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Annex 6: Unit Prices of Health Care Inputs in Low and Middle Income Regions

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Contents

Introduction

The aim of this Annex is to briefly outline the approach used to determine prices for regions for use by chapter authors. Full details on methods employed and sources will be available and discussed in a forthcoming DCPP Working Paper (Mulligan et al, 2003).

This annex provides price data for low and middle-income countries stratified by World Bank region (East Asia and Pacific; Sub Saharan Africa, South Asia, Europe and Central Asia; Middle East and North Africa; Latin America and Caribbean). The prices are intended to reflect a public health system and as far as possible prices are also intended to reflect the opportunity cost of health care resources in each World Bank region. However, as the speed of the exercise also required that the data be collated from publicly accessible sources, many potential sources were unavailable. Thus, the guiding principle was to use the best available data, and to adjust as far as possible where deviations were obvious. Prices provided are for those inputs most likely to be important to total cost or to explaining variation in cost.

Inputs are distinguished by whether the goods are traded or not traded. In general a traded good is a resource that is known to be imported or could have been imported and we have assumed that a single international price exists for all countries for such goods. International prices are derived from WHO publications and non-governmental organizations operating at an international level and exclude costs of shipment and taxes. Prices provided include transport operating costs; building and equipment costs (for drug prices see Box 6-1).

Box 6-1. Drug prices

We have not provided drug prices on the grounds that authors can access a comprehensive price lists already and that reproducing these data would be of little benefit. The International Drug Price Indicator Guide published by Management Sciences for Health is recommended as the principle source of prices for DCPP chapter authors (see http://erc.msh.org). Authors are reminded to use 2001 prices.

The extent to which a single international price exists for drugs is controversial. While an international price may exist for generic drugs there are regional prices for on-patent drugs due to differential pricing by drug companies. DCPP authors are encouraged to explore this in their sensitivity analyses.

The price estimates for non traded inputs are generally based on cost, with data and methods drawn from the WHO-CHOICE work programme (go to http:/www.who.int/evidence/cea for more details). WHO has undertaken a major effort to assess the overall costs and effects of a wide variety of health interventions (see Johns *et al*, 2003 and Adams *et al*, 2003). We have drawn on the results of their analyses to estimate regional unit costs for hospital hotel costs per in-patient day; cost per hospital outpatient day; cost per health center visit; five levels of staff costs. For hospital and health center costs, estimations were first made for each country and then aggregated for

the World Bank regions using population weights (see Box 6-2 for example). For salary costs, the estimates are based on results for WHO regions. These were then mapped to World Bank regions using country population weights.

Box 6-2 Deriving regional average, low and high estimates for the cost per hospital inpatient day: a worked example for South Asia, 2001 International Dollars

Country	Level 1 estimated hospital price (a)	Population /000	Population weight (b)	Population weighted estimate (a) x (b)
Afghanistan	17.63	20764	2%	0.28
Pakistan	18.08	133884	10%	1.86
Bangladesh	15.70	131797	10%	1.59
Bhutan	14.26	645	0%	0.01
India	21.08	976365	75%	15.78
Maldives	34.42[a]	274	0%	0.01
Nepal	13.60[b]	21969	2%	0.23
Sri Lanka	28.68	18573	1%	0.41
Sum for weighted regional average			**(100%)**	**20.16[c]**

[a] SA low estimate	**13.60**
[b] SA high estimate	**34.42**
[c] SA 'best' estimate	**20.16**

Where we did not employ WHO data to estimate costs in different regions (i.e. for laboratory and diagnostic procedures) we used relative price indices derived from the hospital models to transfer costs obtained from the published and unpublished literature to each of the regional groupings (see Box 6-3). To transfer prices across time we used World Bank GDP price deflators (see Box 6-4). All results are presented in 2001 International Dollars.

If you wish to convert these regional costs expressed in international dollars to a country's own currency, then simply multiply the international dollar figure by the PPP exchange conversion factor. For example, 2 international dollars are equal to 908.2 Tanzanian Shillings for the year 2001 (2 * 454.1). To convert local currency units to international dollars, divide the local currency unit by the PPP conversion factor.

Most of the items are average costs rather than true marginal costs and should be used with this in mind. These standardized prices should be attached to quantities of resources (determined by chapter authors) to estimate total costs. Authors are encouraged to use sensitivity analysis to examine the implications for cost-effectiveness ratios of changing quantities (e.g. in response to differences in the relative price of inputs or different scales of production) or changing prices. If authors employ a modeling approach based on

Box 6-3 Transferring prices across regions

In estimating relative prices for laboratory and diagnostic procedures, a number of approaches were adopted depending on the nature of the original price data.

Where only one data point existed

In this situation, we divided the point estimate into traded and non-traded components and applied regional weights (see Table 6-9) to the non-traded components to arrive at relative prices for the other regions.

Worked example: Using a stool microscopy test

Estimate from Malawi, SSA = $2.30 (International dollars 2001)

Step 1 Split estimate into tradable/non-tradable components

Tradable	2.0 (87%)
Non-tradable	0.3 (13%)

Step 2 Multiply non-tradable component by SSA regional weight from Table 6-9
i.e. 0.3 * 2.03 for EAP
0.3 * 3.03 for ECA and so on:

Step 3 Add tradable and non-tradable components together to arrive at regional estimate

	EAP	**ECA**	**LAC**	**MNA**	**SA**	**SSA**
Tradable	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0
Non-tradable	$0.61	$0.92	$0.94	$0.71	$0.39	$0.30
Total	$2.61	$2.92	$2.94	$2.71	$2.40	$2.39

This approach can be used by authors for their own prices.

Where data existed for more than one data point in a region

For all available estimates we calculated regional prices as described above. We then took the average to arrive at the best point estimate and took the highest and lowest estimates to provide the range.

Where data existed for a data point in more than one region

For the remaining regions we took the most appropriate available regional estimate before applying regional weights to the non-traded component. For example if we had estimates from Sub Saharan Africa and South Asia, we would use the estimate from South Asia for East Asia and Pacific.

Box 6-4. Purchasing power parities and relative prices

When cross comparisons are needed the usual practice is to convert prices into a common currency such as the US dollar using market or official exchange rates. However these rates do not necessarily reflect the relative purchasing power of different currencies as one unit of a common currency may buy different quantities of the same item in different countries. Therefore such comparisons may not be meaningful.

Purchasing power parities (PPPs) are rates of currency conversion that equalize purchasing powers of different currencies. They attempt to eliminate the differences in price levels between countries. Thus when prices for different countries are converted into a common currency by means of PPPs, they are in effect expressed at the same set of international prices so that comparisons reflect (or at least attempt to reflect) only differences in the markets for health related inputs. In contrast, comparisons in exchange-rate-converted expenditures (e.g. US dollars) reflect not only differences in the markets for inputs, but also differences in price levels between countries.

All results are presented in current International Dollars of 2001. An international dollar has the same purchasing power as the U.S. dollar has in the United States. Costs in local currency units are converted to international dollars using PPP exchange rates, where the PPP exchange rate is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States.

Prices in local currencies were converted to 2001 international dollars in the following way:

Step 1 Local currencies in year X were converted to local currency in 2001 by use of World Bank country specific GDP deflators (WDI 2003). If prices were quoted in US dollars then these were converted back to local currencies using the quoted exchange rate before converting to 2001 prices.

Step 2 Local currencies in 2001 prices were then converted to international dollars by use of World Bank purchasing power conversion factors.

Sources: Wong and Weng, 1995; WHO-CHOICE website (http://www3.who.int/whosis/cea/prices/ppp.cfm)

probabilistic sensitivity analysis, they should assume a triangular distribution for all categories (Doubilet et al, 1985).

Tables 6-1 to 6-8 provide a breakdown of unit costs by cost category for each region. Notes and assumptions are provided under each table. Table 6-9 provides the regional price weights used to transfer prices across the relevant regions. Official exchange rates and purchasing power conversion factors are provided in Table 6-10.

Finally, because we may be able later to provide an updated set of data, we advise analysis to be constructed in a way that can easily allow prices to change.

Table 6-1. Cost per inpatient hospital bed day (International dollars, 2001)

World Bank region	Hospital level	Best	Low	High
East Asia and Pacific	Primary	$32.01	$14.62	$58.02
	Secondary	$41.76	$19.07	$75.69
	Tertiary	$57.04	$26.05	$103.38
Europe and Central Asia	Primary	$47.89	$13.07	$84.30
	Secondary	$62.48	$17.05	$109.98
	Tertiary	$85.34	$23.29	$150.22
Latin America and Caribbean	Primary	$49.25	$14.25	$74.84
	Secondary	$64.26	$18.60	$97.63
	Tertiary	$87.77	$25.40	$133.35
Middle East and North Africa	Primary	$37.24	$10.06	$69.37
	Secondary	$48.58	$13.12	$90.51
	Tertiary	$66.36	$17.92	$123.62
South Asia	Primary	$20.62	$13.85	$34.37
	Secondary	$26.90	$18.07	$44.83
	Tertiary	$36.75	$24.68	$61.24
Sub-Saharan Africa	Primary	$15.79	$6.52	$85.87
	Secondary	$20.59	$8.51	$112.02
	Tertiary	$28.13	$11.62	$153.01

Notes

a. Costs estimated using a regression model for public hospitals with 80% occupancy rate. Estimate includes hotel costs of hospital stay (capital, salaries, overheads, building, equipment and food). Excludes drugs, diagnostic and laboratory costs. The model controls for cross country price level differences by using unit costs adjusted for PPP and for differences in quantity and complexity of resource use using per capita GDP.

b. Low and high estimates refer to minimum and maximum average country results within each region obtained from model (see Box 6-2) .

c. *Primary-level hospital:* Few specialties, mainly internal medicine, obstetrics-gynecology, pediatrics, general surgery or just general practitioners; limited laboratory services are available for general but not for specialized pathological analysis; *Secondary-level hospital***:** Highly differentiated by function with five to ten clinical specialties; bed size ranging from 200-800 beds; often referred to as provincial hospital; *Tertiary-level hospital:* Highly specialized staff and technical equipment, e.g., cardiology, ICU and specialized imaging units; clinical services are highly differentiated by function; might have teaching activities; bed size ranging from 300-1,500 beds.

d. Country results aggregated to WB regions using population weights (See Box 6-2).

Sources:
WHO CHOICE.

Table 6-2. Cost per outpatient hospital visit (International dollars, 2001)

World Bank region	Hospital level	Best	Low	High
East Asia and Pacific	Primary/secondary	$8.74	$3.59	$17.33
	Tertiary	$12.03	$4.94	$23.86
Europe and Central Asia	Primary/ secondary	$13.08	$2.97	$25.31
	Tertiary	$18.00	$4.08	$34.84
Latin America and Caribbean	Primary/ secondary	$14.17	$3.61	$22.89
	Tertiary	$19.51	$4.97	$31.51
Middle East and North Africa	Primary/ secondary	$10.54	$2.36	$21.05
	Tertiary	$14.51	$5.29	$28.86
South Asia	Primary/ secondary	$3.87	$3.33	$14.83
	Tertiary	$5.32	$4.66	$12.19
Sub-Saharan Africa	Primary/ secondary	$3.20	$1.41	$26.86
	Tertiary	$4.40	$2.11	$25.63

Notes

a. Costs estimated using a regression model for public hospitals with 80% occupancy rate using the same dataset as that for inpatient costs. Estimate includes hotel costs of hospital stay (capital, salaries, overheads, building, equipment and food). Excludes drugs, diagnostic and laboratory costs. The model controls for cross country price level differences by using unit costs adjusted for PPP and for differences in quantity and complexity of resource use using per capita GDP.

b. Outpatient model based on the ratio of inpatient to outpatient costs at facilities

c. Low and high estimates refer to the minimum and maximum country estimate in each region from model (see Box 6-2).

d. *Primary-level hospital:* Few specialties, mainly internal medicine, obstetrics-gynecology, pediatrics, general surgery or just general practitioners; limited laboratory services are available for general but not for specialized pathological analysis; *Secondary-level hospital***:** Highly differentiated by function with five to ten clinical specialties; bed size ranging from 200-800 beds; often referred to as provincial hospital; *Tertiary-level hospital:* Highly specialized staff and technical equipment, e.g., cardiology, ICU and specialized imaging units; clinical services are highly differentiated by function; might have teaching activities; bed size ranging from 300-1,500 beds

e. Results for primary and secondary level facilities combined.

f. Country results aggregated to WB regions using population weights (See Box 6-2).

Source

WHO CHOICE.

Table 6-3. Cost per health center visit (International dollars, 2001)

World Bank region	Estimated population coverage level	Best	Low	High
East Asia and Pacific	90%	$5.36	$3.98	$6.76
	80%	$4.15	$3.08	$5.23
	50%	$3.88	$2.88	$4.90
Europe and Central Asia	90%	$6.20	$3.81	$7.80
	80%	$4.80	$2.95	$6.04
	50%	$4.49	$2.76	$5.65
Latin America and Caribbean	90%	$6.29	$3.94	$7.45
	80%	$4.87	$3.05	$5.77
	50%	$4.55	$2.86	$5.40
Middle East and North Africa	90%	$5.61	$3.45	$7.24
	80%	$4.35	$2.67	$5.60
	50%	$4.07	$2.50	$5.24
South Asia	90%	$4.54	$3.90	$5.53
	80%	$3.51	$3.02	$4.28
	50%	$3.29	$2.82	$4.00
Sub-Saharan Africa	90%	$3.88	$2.92	$7.86
	80%	$3.01	$2.26	$6.08
	50%	$2.81	$2.12	$5.69

Notes

a. Estimates derived from WHO regression models. Model controls for cross country price level differences by using unit costs adjusted for PPP and for differences in quantity and complexity of resource use using per capita GDP. Estimates exclude drug costs.
b. Low and high estimates refer to the minimum and maximum country results obtained within each region from model (See Box 6-2).
c. The model predicts unit prices for different coverage levels and implies that achieving higher coverage entails increased unit costs overall due to lower utilization at peripheral facilities.
d. Country results aggregated to WB regions using population weights (see Box 6-2).

Source
WHO CHOICE.

Table 6-4.1. Annual Salaries (International dollars, 2001)

World Bank region	Level	Best	Low	High
East Asia and Pacific	Level 1 Jobs	$ 5,471	$ 2,945	$ 7,696
	Level 2 Jobs	$ 7,011	$ 3,887	$ 9,652
	Level 3 Jobs	$10,111	$ 5,562	$14,135
	Level 4 Jobs	$17,024	$ 9,324	$23,771
	Level 5 Jobs	$26,885	$13,731	$38,763
Europe and Central Asia	Level 1 Jobs	$ 5,866	$ 3,982	$ 7,681
	Level 2 Jobs	$ 7,517	$ 5,253	$ 9,846
	Level 3 Jobs	$10,842	$ 7,485	$14,108
	Level 4 Jobs	$18,254	$12,379	$23,567
	Level 5 Jobs	$28,828	$18,744	$40,704
Latin America and Caribbean	Level 1 Jobs	$ 6,633	$ 3,678	$ 7,586
	Level 2 Jobs	$ 8,501	$ 4,818	$ 9,483
	Level 3 Jobs	$12,260	$ 6,933	$13,890
	Level 4 Jobs	$20,642	$11,498	$23,266
	Level 5 Jobs	$32,600	$17,167	$39,146
Middle East and North Africa	Level 1 Jobs	$ 8,077	$ 3,898	$15,136
	Level 2 Jobs	$10,351	$ 5,142	$19,187
	Level 3 Jobs	$14,928	$ 7,328	$28,262
	Level 4 Jobs	$25,134	$12,118	$46,974
	Level 5 Jobs	$39,694	$18,348	$79,016
South Asia	Level 1 Jobs	$ 3,523	$ 2,888	$ 7,935
	Level 2 Jobs	$ 4,514	$ 3,812	$10,174
	Level 3 Jobs	$ 6,511	$ 5,455	$14,897
	Level 4 Jobs	$10,962	$ 9,145	$24,755
	Level 5 Jobs	$17,313	$13,466	$40,986
Sub-Saharan Africa	Level 1 Jobs	$ 4,708	$ 3,797	$ 7,798
	Level 2 Jobs	$ 6,034	$ 4,910	$ 9,999
	Level 3 Jobs	$ 8,702	$ 7,154	$14,641
	Level 4 Jobs	$14,652	$11,924	$24,328
	Level 5 Jobs	$23,139	$17,741	$40,280

Notes:

a. Estimates derived from WHO regression models. The models control for cross country price level differences using per capita GDP, population density and WHO region. The final model predicted salaries in US dollars for the 14 WHO regions. The results were then converted to International dollars and mapped to the six World Bank regions using country population weights.

b. Estimate refers to gross salaries including social security contributions.

c. Low and high estimates refer to the minimum and maximum uncertainty levels obtained within each region.

d. The job categories were divided into five educational levels, corresponding to UNESCO's educational classifications. That is, level one job categories require lower secondary education or second stage of basic education, level 2 jobs (upper) secondary education, level 3 jobs post-secondary non-tertiary education, or first stage of tertiary education (not leading directly to an advanced research

qualification), level 4 jobs second stage of tertiary education (leading to an advanced research qualification), and level 5 jobs are the same as level 4 but require additional substantial work experience or specialist training.

e. Country results aggregated to WB regions using population weights (see Box 4-2).

Sources

WHO CHOICE. See also Johns et al, (2003) for general information on methods.

Table 6-4.2. Daily salary rates (International dollars, 2001)

World Bank region	Level	Best	Low	High
East Asia and Pacific	Level 1 Jobs	$ 26.05	$ 14.02	$ 36.65
	Level 2 Jobs	$ 33.38	$ 18.51	$ 45.96
	Level 3 Jobs	$ 48.15	$ 26.49	$ 67.31
	Level 4 Jobs	$ 81.07	$ 44.40	$ 113.19
	Level 5 Jobs	$ 128.03	$ 65.39	$ 184.59
Europe and Central Asia	Level 1 Jobs	$ 27.93	$ 18.96	$ 36.58
	Level 2 Jobs	$ 35.80	$ 25.02	$ 46.89
	Level 3 Jobs	$ 51.63	$ 35.64	$ 67.18
	Level 4 Jobs	$ 86.92	$ 58.95	$ 112.22
	Level 5 Jobs	$ 137.28	$ 89.26	$ 193.83
Latin America and Caribbean	Level 1 Jobs	$ 31.59	$ 17.51	$ 36.12
	Level 2 Jobs	$ 40.48	$ 22.94	$ 45.16
	Level 3 Jobs	$ 58.38	$ 33.02	$ 66.14
	Level 4 Jobs	$ 98.30	$ 54.75	$ 110.79
	Level 5 Jobs	$ 155.24	$ 81.75	$ 186.41
Middle East and North Africa	Level 1 Jobs	$ 38.46	$ 18.56	$ 72.08
	Level 2 Jobs	$ 49.29	$ 24.49	$ 91.37
	Level 3 Jobs	$ 71.09	$ 34.89	$ 134.58
	Level 4 Jobs	$ 119.69	$ 57.70	$ 223.69
	Level 5 Jobs	$ 189.02	$ 87.37	$ 376.27
South Asia	Level 1 Jobs	$ 16.78	$ 13.75	$ 37.78
	Level 2 Jobs	$ 21.50	$ 18.15	$ 48.45
	Level 3 Jobs	$ 31.00	$ 25.98	$ 70.94
	Level 4 Jobs	$ 52.20	$ 43.55	$ 117.88
	Level 5 Jobs	$ 82.44	$ 64.13	$ 195.17
Sub-Saharan Africa	Level 1 Jobs	$ 22.42	$ 18.08	$ 37.13
	Level 2 Jobs	$ 28.73	$ 23.38	$ 47.61
	Level 3 Jobs	$ 41.44	$ 34.07	$ 69.72
	Level 4 Jobs	$ 69.77	$ 56.78	$ 115.85
	Level 5 Jobs	$ 110.19	$ 84.48	$ 191.81

Notes

a. Derived from annual salaries, based on a working year of 42 weeks p.a. 5 days p.w. (author estimate)

Table 6-5. Costs of selected laboratory tests and hospital procedures (International dollars, 2001)

	Region						
	EAP	**ECA**	**LAC**	**MNA**	**SA**	**SSA**	**Sources**
Malaria Microscopy test							
Best	$1.53	$1.79	$1.89	$1.64	$1.33	$1.28	Essential Laboratory Services Project (2001)
Low	$1.15	$1.23	$1.26	$1.19	$1.10	$1.08	Goodman et al (2000)
High	$1.91	$2.30	$2.45	$2.07	$1.61	$1.53	
Malaria Dipstick test							
Best	$5.80	$6.21	$6.24	$5.94	$5.51	$5.39	Goodman et al (2000)
Low	$4.67	$5.00	$5.03	$4.78	$4.44	$4.34	Yeung personal communication
High	$6.82	$7.30	$7.34	$6.98	$6.48	$6.34	
Cost per unit of safe blood transfused							
Best	$44.42	$50.15	$50.64	$46.31	$40.32	$38.57	Essential Laboratory Services Project (2001)
Low	$39.36	$44.44	$44.87	$41.03	$35.73	$34.18	Schwartländer et al (2001)
High	$49.48	$55.86	$56.41	$51.58	$44.91	$42.97	
TB Microscopy test							
Best	$5.62	$7.35	$7.49	$6.19	$4.39	$3.86	Essential Laboratory Services Project (2001)
Low	$4.10	$5.36	$5.47	$4.52	$3.20	$2.82	Barnum (1983)
High	$6.52	$8.51	$8.68	$7.17	$5.09	$4.48	Floyd et al. (1997)
Stool microscopy test							
Point estimate only	$2.61	$2.92	$2.94	$2.71	$2.40	$2.30	Essential Laboratory Services Project (2001)
Hemoglobin test							
Point estimate only	$2.57	$3.40	$3.47	$2.84	$1.97	$1.72	Essential Laboratory Services Project (2001)

	Region						
	EAP	**ECA**	**LAC**	**MNA**	**SA**	**SSA**	**Sources**
HIV: Voluntary counseling and testing, per person							
Best	$49.52	$71.39	$73.26	$56.72	$33.83	$27.17	Schwartländer et al (2001)
Low	$31.58	$45.54	$46.73	$36.18	$21.58	$17.33	Marseille (1999)
High	$116.86	$168.48	$172.90	$133.85	$79.85	$64.13	
Operating theatre time, cost per minute							
Point estimate only	$11.36	$16.50	$16.94	$13.05	$7.68	$6.12	Shepard (1993)
X ray test, per test							
Point estimate only	$18.99	$27.38	$28.10	$21.75	$12.98	$10.42	Barnum (1983)
Generic laboratory cost per patient							
Point estimate only	$53.51	$69.26	$70.61	$58.69	$42.21	$37.42	Personal communication with Dr Charles Hongoro, LSHTM.

Notes on all lab and procedure costs

- Includes staff, equipment, supplies and overheads
- Split into traded and non-traded components. Regional price adjustments made to non-traded components
- District hospital setting

Notes on blood transfusion costs

- Includes all the costs associated with screening the donor for anaemia, hepatitis B, syphilis and HIV, bleeding the donor, determining the blood group of the donor and the recipient and checking the donor recipient compatibility of the blood.

Notes on Hemoglobin test

- Using HCN reference method

Table 6-6. Equipment costs (International dollars, 2001)

Item	Unit cost	Estimated useful life years (a)	Source
Vehicles			
4 Wheel Drive 4000 cc (Toyota Landcruiser hardtop)	$24,238	9	Gerry Mission Supplies (personal communication)
Motorcycle 97 cc (on/off road)	$1,491	7	WHO (2000)
Major Equipment			
Portable X ray Unit	$7,150	10	Durbin PLC (2002)
Reconditioned Mobile X ray unit	$3,972	5	Durbin PLC (2002)
Refrigerator	$278	11	Durbin PLC (2002)
Refrigerator, tropcalized, transportable	$1,653	11	Durbin PLC (2002)
Instruments and other equipment			
Microscope	$542	10	Durbin PLC (2002)
Sphymomanometers (hand held with adult cuff)	$14	8	Durbin PLC (2002)
Stethoscope (economy model)	$6	8	Durbin PLC (2002)
Thermometers	$1	8	Durbin PLC (2002)
Weighing scales (infant and toddlers)	$68	8	Durbin PLC (2002)
Weighing scales (new born infants)	$26	8	Durbin PLC (2002)
Vaccine carrier (1.7 liters)	$33	6	Durbin PLC (2002)
Vaccine carrier (0.6 liters)	$97	6	Durbin PLC (2002)

Notes

a. Life expectancies taken from Goodman (2000), Halbwachs (2000) and WHO CHOICE. Assume equipment bought in good condition and well maintained.
b. Authors should add a standard 15% markup to include freight, insurance, unloading and distribution.

Table 6-7.1. Fuel cost per liter (International Dollars, 2001)

World Bank region	Regional estimate	International price
East Asia and Pacific	$0.49	$0.24
Europe and Central Asia	$0.83	$0.24
Latin America and Caribbean	$0.63	$0.24
Middle East and North Africa	$0.35	$0.24
South Asia	$1.42	$0.24
Sub-Saharan Africa	$0.98	$0.24

Notes

a. Data are based on a survey of pump prices by GTZ Metschies G (1999) reproduced by the World Bank

b. Refers to the untaxed pump price of the most widely sold grade of super gasoline.

c. To estimate the regional untaxed pump price we used methodology suggested by WHO CHOICE. We divided all countries into four regions based on GTZ's classification (subsidized prices, low tax, middle tax and high tax). We then subtracted the minimal tax rate for these classifications since an average tax rate results in some negative numbers. For countries subsidizing gasoline prices we used the international untaxed pump price. This method does not completely eliminate taxes but brings the pump price closer to the untaxed price.

d. Untaxed international price estimated by GTZ in 2001 prices

e. Country results aggregated to WB regions using population weights (see Box 6-2).

Sources

World Bank (2003)
Metschies G (1999)
WHO CHOICE.

Table 6-7.2. Vehicle running costs per km (International Dollars, 2001)

World Bank region	Best estimate	
	4 Wheel Drive	Motorbike
East Asia and Pacific	$0.07	$0.01
Europe and Central Asia	$0.12	$0.03
Latin America and Caribbean	$0.09	$0.02
Middle East and North Africa	$0.05	$0.01
South Asia	$0.20	$0.04
Sub-Saharan Africa	$0.14	$0.03

Notes

a. Includes servicing and repairs, tires. Excludes driver.

b. Assumes 40% mark-up for maintenance and service for car and 22% mark-up for bike (South African Automobile Association)

c. Assume fuel consumption of 10km/liter for car and 40km/liter for bike

d. Vehicle running costs split into traded and non-traded components. Regional price adjustments made to non-traded components (see Table 6-9 for weights).

Sources

World Bank, 2003 (for fuel costs)
South African Automobile Association (for service mark-up) (www.diskdrive.co.za/leaseplan/aa_rates.htm)

Table 6-8. Building cost per square meter (International dollars, 2001)

World Bank region	Best estimate	
	Office	**Basic**
East Asia and Pacific	$197.85	$93.00
Europe and Central Asia	$120.35	$56.78
Latin America and Caribbean	$40.06	$17.34
Middle East and North Africa	$74.24	$49.54
South Asia	$97.33	$68.54
Sub-Saharan Africa	$69.32	$39.46

Notes

a. Economic cost per year, Assumes 20 year life span, discount rate 3%

b. *Office*: building cost for a typical building in an urban location. Includes suspended ceilings, air-conditioning, lighting and power.

c. Estimates include general facilities provided by the building contractor to enable work to take place such as site administration, supervision and co-ordination, temporary site accommodation, hoists and cranes.

d. Country results aggregated to WB regions using population weights (see Box 6-2).

Sources

Gardiner & Theobald (2002) (available at: http://www.ridersyd.com.au/webdocs/costdata.asp)

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Table 6-9. Regional weights for transferring the prices of hospital related non-tradable inputs.

WB region	Relative price weight (Sub-Saharan Africa = 1)	Relative price weight (Latin America = 1)	Relative price weight (South Asia = 1)
East Asia and Pacific	2.03	0.65	1.55
Europe and Central Asia	3.03	0.97	2.32
Latin America and Caribbean	3.12	1.00	2.39
Middle East and North Africa	2.36	0.76	1.81
South Asia	1.31	0.42	1.00
Sub-Saharan Africa	1.00	0.32	0.77

Notes

a. Price weights derived from a weighted average of hospital inpatient prices.

b. Costs estimated using a regression model for public hospitals with 80% occupancy rate. Estimate includes hotel costs of hospital stay (capital, salaries, building, equipment and food).

c. Weights obtained by dividing each regional hospital cost estimate by the hospital cost estimate in the reference category. No original unit cost data obtained from MNA or ECA, thus relative weights are not provided for these regions. However authors can use this method for any indices for which a need arises (e. g., for health center costs or level 4 workers).

Table 6-10. Official exchange rates and purchasing power conversion factors, 2001

Country	Region	Official exchange rate	Purchasing power parity (PPP) conversion factor
		local currency units to $	local currency units to international $
Cambodia	East Asia/Pacific	3916.33	585.9
China	East Asia/Pacific	8.28	1.9
Korea, Dem. Rep.	East Asia/Pacific	-	-
Fiji	East Asia/Pacific	-	-
Indonesia	East Asia/Pacific	10260.85	2423.7
Kiribati	East Asia/Pacific	-	-
Lao PDR	East Asia/Pacific	8954.58	1790.3
Malaysia	East Asia/Pacific	3.80	1.6
Marshall Islands	East Asia/Pacific	-	-
Micronesia, Fed. Sts.	East Asia/Pacific	-	-
Mongolia	East Asia/Pacific	1097.70	273.8
Myanmar	East Asia/Pacific	6.75	-
Palau	East Asia/Pacific	-	-
Papua New Guinea	East Asia/Pacific	3.39	0.7
Philippines	East Asia/Pacific	50.99	12.1
Samoa	East Asia/Pacific	-	-
Solomon Islands	East Asia/Pacific	-	-
Thailand	East Asia/Pacific	44.43	13.0
Tonga	East Asia/Pacific	-	-
Vanuatu	East Asia/Pacific	-	-
Vietnam	East Asia/Pacific	14725.17	2945.8
Albania	Europe and Central Asia	143.48	50.7
Armenia	Europe and Central Asia	555.08	116.2
Azerbaijan	Europe and Central Asia	4656.58	1061.4
Belarus	Europe and Central Asia	1390.00	222.7
Bosnia and Herzegovina	Europe and Central Asia	-	0.4
Bulgaria	Europe and Central Asia	2.18	0.5
Croatia	Europe and Central Asia	8.34	4.2
Czech Republic	Europe and Central Asia	38.04	14.3
Estonia	Europe and Central Asia	17.56	7.0
Georgia	Europe and Central Asia	2.07	0.5
Hungary	Europe and Central Asia	286.49	118.4
Kazakhstan	Europe and Central Asia	146.74	33.9
Kyrgyz Republic	Europe and Central Asia	48.38	5.4
Latvia	Europe and Central Asia	0.63	0.3
Lithuania	Europe and Central Asia	4.00	1.6
Poland	Europe and Central Asia	4.09	2.0
Moldova	Europe and Central Asia	12.87	2.1
Romania	Europe and Central Asia	29060.79	8832.0
Russian Federation	Europe and Central Asia	29.17	8.8
Slovak Republic	Europe and Central Asia	48.35	15.3
Tajikistan	Europe and Central Asia	2.37	0.3

Country	Region	Official exchange rate local currency units to $	Purchasing power parity (PPP) conversion factor local currency units to international $
Macedonia, FYR	Europe and Central Asia	68.04	18.7
Turkey	Europe and Central Asia	1225588.00	464782.5
Turkmenistan	Europe and Central Asia	5200.00	1321.7
Ukraine	Europe and Central Asia	5.37	0.9
Uzbekistan	Europe and Central Asia	236.61	79.0
Yugoslavia, Fed. Rep.	Europe and Central Asia	-	-
Antigua and Barbuda	Latin America and the Caribbean	-	-
Argentina	Latin America and the Caribbean	1.00	0.6
Barbados	Latin America and the Caribbean	-	-
Belize	Latin America and the Caribbean	-	-
Bolivia	Latin America and the Caribbean	6.61	2.7
Brazil	Latin America and the Caribbean	2.36	0.9
Chile	Latin America and the Caribbean	634.94	298.1
Colombia	Latin America and the Caribbean	2299.63	625.8
Costa Rica	Latin America and the Caribbean	328.87	144.9
Cuba	Latin America and the Caribbean	-	-
Dominica	Latin America and the Caribbean	-	-
Dominican Republic	Latin America and the Caribbean	16.95	6.0
Ecuador	Latin America and the Caribbean	1.00	0.4
El Salvador	Latin America and the Caribbean	8.75	3.6
Grenada	Latin America and the Caribbean	-	-
Guatemala	Latin America and the Caribbean	7.86	3.1
Guyana	Latin America and the Caribbean	-	-
Haiti	Latin America and the Caribbean	24.43	5.9
Honduras	Latin America and the Caribbean	15.47	5.3
Jamaica	Latin America and the Caribbean	46.00	37.1
Mexico	Latin America and the Caribbean	9.34	6.9
Nicaragua	Latin America and the Caribbean	13.37	-
Panama	Latin America and the Caribbean	1.00	0.6
Paraguay	Latin America and the Caribbean	4105.92	1007.2
Peru	Latin America and the Caribbean	3.51	1.6
St. Kitts and Nevis	Latin America and the Caribbean	-	-
St. Lucia	Latin America and the Caribbean	-	-
St. Vincent and the Grenadines	Latin America and the Caribbean	-	-
Suriname	Latin America and the Caribbean	-	-
Trinidad and Tobago	Latin America and the Caribbean	6.23	4.6
Uruguay	Latin America and the Caribbean	13.32	8.8
Venezuela, RB	Latin America and the Caribbean	723.67	648.0
Algeria	Middle East and North Africa	77.22	22.5
Djibouti	Middle East and North Africa	-	-
Egypt, Arab Rep.	Middle East and North Africa	3.97	1.6
Iran, Islamic Rep.	Middle East and North Africa	1753.56	1714.0
Iraq	Middle East and North Africa	0.31	-
Jordan	Middle East and North Africa	0.71	0.3

Country	Region	Official exchange rate local currency units to $	Purchasing power parity (PPP) conversion factor local currency units to international $
Lebanon	Middle East and North Africa	1507.50	1377.8
Libya	Middle East and North Africa	0.60	-
Malta	Middle East and North Africa	-	-
Morocco	Middle East and North Africa	11.30	3.7
Oman	Middle East and North Africa	0.38	0.3
Saudi Arabia	Middle East and North Africa	3.74	2.4
Syrian Arab Republic	Middle East and North Africa	11.23	18.0
Tunisia	Middle East and North Africa	1.44	0.5
Yemen, Rep.	Middle East and North Africa	168.67	109.4
Afghanistan	South Asia	3000.00	-
Bangladesh	South Asia	55.81	11.8
Bhutan	South Asia	-	-
India	South Asia	47.19	7.8
Maldives	South Asia	-	-
Nepal	South Asia	74.95	13.3
Pakistan	South Asia	61.93	12.8
Sri Lanka	South Asia	89.38	23.5
Angola	Sub-Saharan Africa	22.06	7.6
Benin	Sub-Saharan Africa	733.04	275.3
Botswana	Sub-Saharan Africa	5.84	2.3
Burkina Faso	Sub-Saharan Africa	733.04	140.6
Burundi	Sub-Saharan Africa	830.35	120.0
Cameroon	Sub-Saharan Africa	733.04	247.2
Cape Verde	Sub-Saharan Africa	-	-
Central African Republic	Sub-Saharan Africa	733.04	144.6
Chad	Sub-Saharan Africa	733.04	138.8
Comoros	Sub-Saharan Africa	-	-
Congo, Rep.	Sub-Saharan Africa	733.04	667.3
Cote d'Ivoire	Sub-Saharan Africa	733.04	312.4
Congo, Dem. Rep.	Sub-Saharan Africa	21.82	43.4
Equatorial Guinea	Sub-Saharan Africa	-	-
Eritrea	Sub-Saharan Africa	-	1.7
Ethiopia	Sub-Saharan Africa	8.46	1.0
Gabon	Sub-Saharan Africa	733.04	420.6
Gambia, The	Sub-Saharan Africa	15.69	2.2
Ghana	Sub-Saharan Africa	7170.76	857.7
Guinea	Sub-Saharan Africa	1950.56	392.4
Guinea-Bissau	Sub-Saharan Africa	733.04	123.0
Kenya	Sub-Saharan Africa	78.56	29.7
Lesotho	Sub-Saharan Africa	8.61	1.4
Liberia	Sub-Saharan Africa	48.58	-
Madagascar	Sub-Saharan Africa	6588.49	2275.3
Malawi	Sub-Saharan Africa	72.20	21.0
Mali	Sub-Saharan Africa	733.04	214.6
Mauritania	Sub-Saharan Africa	255.63	47.2

Country	Region	Official exchange rate local currency units to $	Purchasing power parity (PPP) conversion factor local currency units to international $
Mauritius	Sub-Saharan Africa	29.13	10.5
Mozambique	Sub-Saharan Africa	20703.64	3622.5
Namibia	Sub-Saharan Africa	8.61	2.1
Niger	Sub-Saharan Africa	733.04	144.3
Nigeria	Sub-Saharan Africa	111.23	41.6
Rwanda	Sub-Saharan Africa	442.99	69.4
Sao Tome and Principe	Sub-Saharan Africa	-	-
Senegal	Sub-Saharan Africa	733.04	230.7
Seychelles	Sub-Saharan Africa	-	-
Sierra Leone	Sub-Saharan Africa	1986.15	615.1
Somalia	Sub-Saharan Africa	-	-
South Africa	Sub-Saharan Africa	8.61	2.0
Sudan	Sub-Saharan Africa	258.70	52.0
Swaziland	Sub-Saharan Africa	8.61	2.3
Togo	Sub-Saharan Africa	733.04	119.8
Uganda	Sub-Saharan Africa	1755.66	295.0
Tanzania	Sub-Saharan Africa	876.41	454.1
Zambia	Sub-Saharan Africa	3610.94	1645.2
Zimbabwe	Sub-Saharan Africa	55.05	17.0

Source: World Development Indicators 2003

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Annex 7: Suggested analytical approaches, according to data availability

Suppose there are 20 interventions (including combinations of interventions) corresponding to a disease, condition or risk factor; and the evidence on costs and effects of the interventions can be classified as follows, where N= number of interventions:

EFFECTIVENESS DATA	COST DATA	
	Available	Not available
Not available	N=2 A	N=10 E
Strong evidence of harm	N=1 B	N=0 F
Strong evidence of benefit	N=1 C	N=1 G
Mixed evidence of effect	N=3 D	N=2 H

Information on any intervention or combination of them could be derived from one or several evaluations. Some of these may be very different interventions and for very different diseases even within one chapter. The question is how to analyze each of these possibilities of information.

Cells A/E: note that information is not available and either leave as a suggestion for future research, or develop a model based only on expert opinion if that appears feasible. Assess, if possible, how important it is that the lack of information affects a large share (50% in this example) of all the known interventions. Where only cost data are available (cell A), they should be reported and compared to costs for alternative interventions. If feasible, some assessment can be made of whether the intervention looks likely to be cost-effective or not.

Cells B/C/D: B and C differ only in the sign of the benefit outcome; D can be treated similarly if the mixed evidence is judged to be fairly conclusive. Combine the cost and effectiveness data and, depending on feasibility, try one of the following: (1) develop probabilistic models of C-E; (2) use an epidemiological model if one exists and combine with resource use data described in cost studies (if available); (3) use an epidemiological model if it exists, and estimate resource use required for operating intervention in a range of settings and apply unit costs to those inputs—estimate to represent a consensus of expert opinion if possible; and (4) if no epidemiological model is to hand, develop a model and apply costs in fashion of 2(2) or 2(3). Whatever approach is taken, spell out assumptions and data used.

Cells F/G/H: (1) develop a consensus estimate of resource use required for operating the intervention in a range of settings and apply unit costs; combine with an epidemiological model if one exists; (2) do not provide estimates of CE if an epidemiological model does not exist; report only the effectiveness evidence, point to need for research on costs.

The approach(es) actually used in each chapter will depend not only on the availability of the two key kinds of information but on whether an epidemiological model exists or can be readily developed, on how many interventions need to be considered in the chapter, and on the availability and degree of consensus in expert opinion. The responsible Editor will advise on how much effort to invest in each of these cases.